California Regional Water Quality Control Board
Central Coast Region

Total Maximum Daily Loads for Fecal Coliform in Cuyama, Santa Maria, Orcutt-Solomon, and Oso Flaco Watersheds, and Total Coliform in Santa Maria River Estuary, in Santa Barbara and San Luis Obispo Counties, California

Draft Project Report
May 29, 2008

Adopted by the
California Regional Water Quality Control Board
Central Coast Region
on _______________, 200x

Approved by the
State Water Resources Control Board
on _______________, 200x
and the
Office of Administrative Law
on _______________,200x
and the
United States Environmental Protection Agency
on _________________, 200x

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To request copies of the Basin Plan Amendment and Draft Final Project Report for Total Maximum Daily Loads for Fecal Coliform in Cuyama, Santa Maria, Orcutt-Solomon, and Oso Flaco Watersheds and Total Coliform in the Santa Maria Estuary, Santa Barbara and San Luis Obispo Counties, California, please contact Katie McNeill at (805) 549-3336, or by email at kmcneill@waterboards.ca.gov.
Documents also are available at:
http://www.waterboards.ca.gov/centralcoast/TMDL/303dandTMDLprojects.htm

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and support and input provided by
Numerous stakeholders, including agencies, organizations, and individuals who have a special interest in the Cuyama, Santa Maria, Orcutt-Solomon, and Oso Flaco watersheds.

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LIST OF ACRONYMS AND ABBREVIATIONS

CCAMP	Central Coast Ambient Monitoring Program
CEQA	California Environmental Quality Act
E. coli	*Escherichia coli Bacteria*
GIS	Geographic Information System
MPN	Most Probable Number
MRLC	Multi-Resolution Land Characterization
MS4	Municipal Separate Storm Sewer Systems
NPDES	National Pollutant Discharge Elimination System
REC-1	Water Contact Recreation
REC-2	Non-Water Contact Recreation
SWMP	Storm Water Management Program
TMDL	Total Maximum Daily Load
UAA	Use Attainability Analysis
USGS	United States Geologic Survey
Water Board	Regional Water Quality Control Board (Region 3)
WDR	Waste Discharge Requirements
WWTP	Waste Water Treatment Plant

1 PROJECT DEFINITION

Central Coast Regional Water Quality Control Board (Water Board) Staff addressed the impairment of numerous waterbodies in this project report (report). Several of these water bodies were identified on the 303(d) list for fecal coliform. Water Board staff also addressed waterbodies that were not included on the 303(d) list, but were impaired. Staff addressed the total coliform impairment of the Santa Maria Estuary as well. These waterbodies and impairments will be included on the 303(d) list in 2008. Oso Flaco Lake is not listed on the 303(d) list because the levels are within water quality objectives. As such, staff did not develop TMDLs for Oso Flaco Lake. Table 1 identifies 303(d) listed waterbodies and those staff assigned TMDLs.

Table 1. Waterbodies Listed and Assigned TMDLs.

WATERBODY	303(d) LISTED? (Y/N)	ASSIGNED TMDL (Y/N)?
Alamo Creek	Y	Y
Cuyama River*	N	Y
Nipomo Creek	Y	Y
Santa Maria River	Y	Y
Blosser Channel	N	Y
Main Street Canal	N	Y
Bradley Channel	Y	Y
Bradley Canyon Creek	Y	Y
Santa Maria Estuary	N	Y
Orcutt-Solomon Creek	Y	Y
Oso Flaco Creek	Y	Y
Little Oso Flaco Creek	N	Y
Oso Flaco Lake	N	N

The Santa Maria River Estuary is a receiving waterbody for several of the above named waterbodies and is designated as supporting the shellfish harvesting beneficial use for which there are associated coliform water quality objectives. This waterbody is not identified on the 303(d) list for total and fecal coliform, but staff addressed this impaired waterbody and associated beneficial uses in this report.

Water Board staff aligned the schedule and scope of this project with the Vision of healthy watersheds. Water Board staff has identified three measurable goals as part of the Vision of healthy watersheds. This project aligns with two of the Water Board's goals as follows:

> **Goal 1: By 2025 80% of Aquatic Habitat is healthy; and the remaining 20% exhibits positive trends in key parameters** (by assessing total and fecal coliform levels and implementing strategies to support recreation and shellfish harvesting beneficial uses).
>
> **Goal 2: By 2025 80% of lands within any watershed will be managed to maintain proper watershed functions, and the remaining 20% will exhibit positive trends in key watershed parameters** (by evaluating existing regulatory programs and additional actions needed to correct the impairment).

Staff initiated this project because they prioritized it higher than other projects in the region. In February 2002, the same time staff ranked this project as high priority, there were no regulatory programs in place for many land uses in the project area (e.g. urban, agriculture, rangeland). In February 2007, the Water Board reaffirmed support for giving high priority to water bodies in need of source analyses and new programs and regulations higher than those with existing efforts in place. Additionally, staff prioritized this project based on the initial observation that fecal coliform levels were higher than those measured in other watersheds.

In February 2008, staff re-evaluated region-wide TMDL projects and alignment with the Vision, and determined this project was a lower priority than other high priority projects due to the level of recreational uses in the project area, but was still an important project to devote resources to through TMDL adoption based on the need for new programs and the level of fecal coliform. Concurrently, Water Board staff collected an additional year of ambient water quality data in the project area. As such, staff delayed this project's schedule to allocate resources to other high priority TMDL projects, as well as to be able to incorporate additional fecal and total coliform data into the project analyses. Staff incorporated the additional data into the project report in March 2008 and plans to submit the project for review in June 2008.

Staff prepared this report in the context of existing implementation and monitoring efforts, some of which are regulatory requirements, which address the bacterial impairment. As part of this report, staff identified possible implementation actions, or alternatives that will further address controllable bacterial sources. Staff aligned the Implementation Plan with the Water Board's Vision. For example, the Implementation Plan includes revising ordinances and applying low impact development (LID) principles to urban development.

This report was also prepared while several regulatory options were being evaluated, developed and/or pursued. At the time of writing, staff surmised that owners of grazing lands and irrigated agriculture, in particular leafy greens and strawberries, were working with agencies and industry to address pathogen management and prevent food borne illnesses while protecting water quality. Additionally, Water Board staff evaluated the appropriateness of developing a region-wide regulatory mechanism for grazing lands, instead of watershed-based grazing lands regulations.

Staff evaluated existing regulatory mechanisms that will implement the TMDLs and identified new mechanism needed as well. Staff concluded it was appropriate to develop an Animal Waste Discharge Prohibition and Human Waste Discharge Prohibition to implement the TMDLs in this report. Staff used the information contained in this report as the foundation for development of Basin Plan Amendment documents.

2 WATERSHED DESCRIPTION

The Cuyama, Santa Maria and Oso Flaco watersheds are located in northwestern Santa Barbara County and Southwestern San Luis Obispo County, California. The watersheds are about 50 miles north of Point Conception and about 150 miles south of Monterey Bay on the central California coast. The climate is mild with 14 inches average rainfall a year.

The area is a broad alluvial plain near the ocean, tapering gradually inland. Upland or mesa areas, foothills, and mountain complexes further define the alluvial plain boundary. The following information was taken from the Santa Maria Estuary Enhancement Plan (SMEEP, March, 2004):

> The Guadalupe-Nipomo Dunes complex, located approximately 40 miles north of Point Conception, is one of the most extensive coastal dune and dune wetland habitats in the nation. The Santa Maria River is one of the largest rivers on the central coast of California (between Point Lobos and Point Conception), and it begins at the confluence of the Cuyama and Sisquoc rivers. The Santa Maria River flows through the dunes complex and forms the estuary at its mouth. Portions of the upper Sisquoc River, from its origin in the Los Padres National Forest boundary, was designated as wild and scenic (Public Law 90-542, 16 U.S.C. 1271-1287, as amended) in 1992. Other major tributaries that contribute to the Santa Maria or Sisquoc River include La Brea Creek, Tepusquet Creek, and Foxen Creek that flow into the Sisquoc River, and Nipomo Creek, Suey Creek, and Solomon-Orcutt Creek that flow into the Santa Maria River. Huasna Creek and Alamo Creek also flow into the Cuyama River upstream from Twitchell Reservoir.
>
> Downstream of Highway 1 the Santa Maria River flows freely in the natural riverbed and the channel is bordered by extensive stands of riparian vegetation (dominated by willows) in some areas, and earthen agricultural levees adjacent to cultivated fields and urbanized portions of the City of Guadalupe on the southern high river terrace. Levees in the study reach were constructed for the purpose of protecting bottomland fields from flood flows and were constructed by individual landowners rather than by the U.S. Army Corps of Engineers (USACE) or the Santa Barbara Flood Control District (SBFCD).
>
> Upstream of Highway 1 the Santa Maria River is physically constrained by earthen and rock levees that were constructed by the USACE in the 1950s to protect the City of Santa Maria and adjacent agricultural lands from flooding. Flows from the Cuyama River are regulated by Twitchell Dam, which was also constructed by the Bureau of Reclamation in the 1950s as part of the comprehensive Santa Maria Flood Control Project. Twitchell Dam functions both as a water conservation and flood control facility. The USACE levees extend from Fugler Point (near the town of Garey) and

terminate at the upstream side of the Highway 1 Bridge in the City of Guadalupe.

The Santa Maria River exhibits substantial variability in its hydrology and biology. Upstream of Highway 1, the river is dry for most of the year, flowing intermittently in a braided pattern during and shortly after rainfall events, and during releases from Twitchell Dam[1]. Riparian vegetation in this reach is comprised primarily of willows, mulefat, with mock heather, coyote brush, other coastal scrub species on higher terraces, and weeds; vegetation is not contiguous and is absent in some reaches along the levees and in the scour zones. Downstream from Highway 1, shallow surface water is almost always present and riparian vegetation is more prevalent, in some places forming a wide, dense riparian corridor. Flows observed during the dry season above Highway 1 are largely a result of agricultural or urban runoff, and releases from Twitchell Dam that are conducted for the purpose of recharging the Santa Maria groundwater basin. Alternatively, flows observed downstream from Highway 1 during the dry season are due primarily to agricultural and urban runoff, as well as emergence of subsurface flow. A significant source of water into the estuary is Solomon-Orcutt Creek, which drains a primarily agricultural area as well as the community of Orcutt for a watershed area of approximately 50,000 acres.

The Santa Maria Valley groundwater basin extends south from the Nipomo Mesa to the Orcutt Uplands. The Santa Maria groundwater basin is divided into five sub-basins: the Santa Maria, Orcutt, Nipomo, and Upper and Lower Guadalupe sub-basins. The Upper Guadalupe sub-basin constitutes the upper unconfined portion of the sub-basin and the Lower-Guadalupe is a deeper confined aquifer separated from the upper sub-basin by clay layers. Coarse-grained alluvial channel deposits in the river grade to finer silt and clay flood deposits as distance from the river channel increases.

The groundwater system supplies most of the area's water supplies, and is closely related to the impairments. The land uses in the Cuyama, Santa Maria, Orcutt-Solomon, and the Oso Flaco watersheds (the Project Area) are a mosaic of open space including rangeland, irrigated agriculture, rural residential, and urban areas.

The Santa Maria River flows directly to the Santa Maria Estuary. The following information on the Santa Maria Estuary was taken from an online document (http://coastalchange.ucsd.edu/st1_thenandnow/maria.html):

> An unusual crescent beach cell, the Santa Maria littoral cell is an excellent example of the action of headlands in containing littoral transport. Its north/south trending coast is exposed to the open ocean without any island sheltering. The shelf is wide and gently sloped with no submarine canyon sink. The headland of Point Sal acts as a groin and has trapped abundant sediment principally from the Santa Maria River.

1 The purpose of the releases from Twitchell Dam is to recharge the Santa Maria groundwater basin. During dry periods of the year, water is released at a rate to ensure percolation occurs upstream of the Bonita School Road crossing (Santa Maria Valley Water Conservation District).

Widespread dune fields are evidence of the plentiful sand supply to this cell.

As rising sea level moved the coastline into the wave shadow of Point Buchon 12-11,000 years ago, beaches backed by dunes probably were building on the wide, gently sloping shelf. Intermittent but strong El Niños in the period 12-8,000 years ago brought huge amounts of sand to the coast, and the El Niño wave direction transported sand to the northern beaches in the shelter of Point Buchon. Under the predominantly La Niña wave climate 8-5,000 years ago, the massive headland of Buchon sheltered the beaches from northwest waves.

Estuaries developed behind the dunes as rising sea level flooded stream valleys. One of the largest estuarine systems in southern California formed near the mouth of the Arroyo Grande. Nearby, the oldest archaeological sites in the Santa Maria cell, dated to more than 9,000 years ago, contain lots of estuarine shell and the earliest radiocarbon dates on Pismo clam for the entire coast of southern California. The Pismo clam is a large slow-growing bivalve that lives only on wave-swept, perennial sand beaches.

The major watersheds in the Project Area are shown in Figure 1.

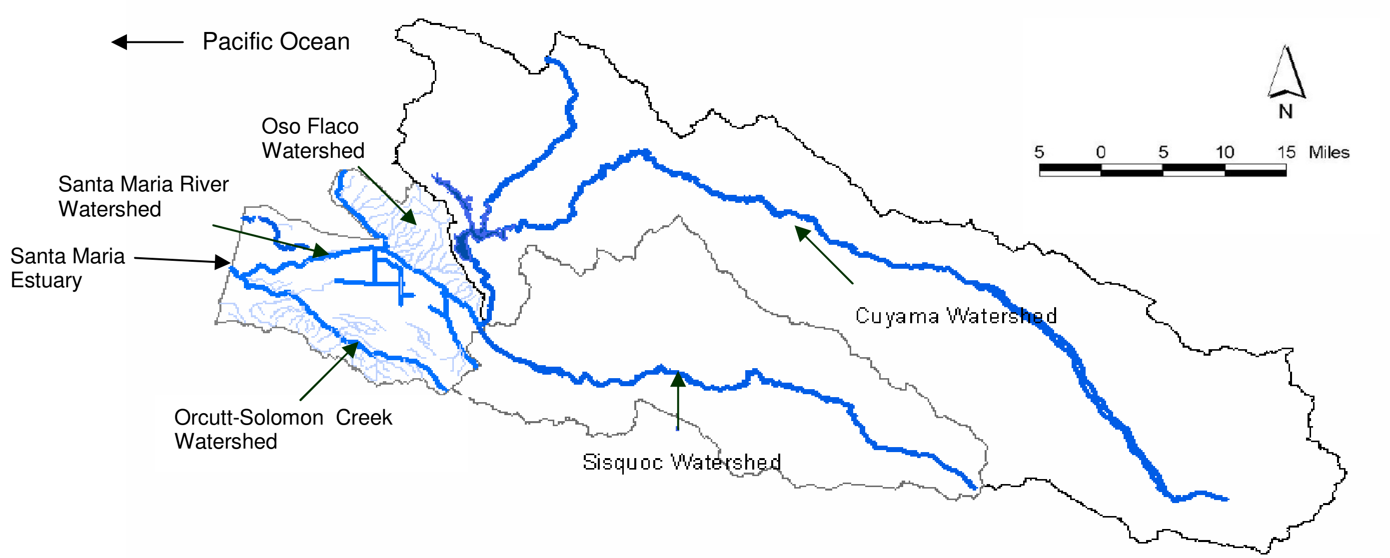


Figure 1. Major Watersheds and Waterbodies in the Project Area.

2.1 Beneficial Uses

The Water Board is responsible for protecting water resources from pollution and nuisance that may occur as a result of waste discharges. The Water Board determines beneficial uses in the *Water Quality Control Plan* (Basin Plan) that need protection and adopts water quality objectives that are necessary to protect the beneficial water uses detailed in the Basin Plan.

The beneficial uses associated with human health are the principal water quality consideration with respect to fecal coliform. Bacterial indicator organisms, e.g., fecal coliform and *E. coli*, are commonly used for predicting the presence of pathogenic organisms. Staff refers to fecal indicator bacteria including total coliform, fecal coliform, and *E.coli* throughout the document. If a concentration threshold of indicator bacteria is detected in a sample, pathogenic organisms are likely present. Elevated levels of fecal coliform are indication that the water bodies may be unsafe for swimming, fishing or other forms of water contact and non-contact recreation (REC-1 and REC-2) activities. Elevated levels of total coliform are an indication that the waterbodies may be unsafe for shellfish harvesting (SHELL).

The Basin Plan specifically identifies beneficial uses for some of the listed water bodies included in this analysis. The Santa Maria River, Santa Maria Estuary, Cuyama River, Alamo Creek, Orcutt Creek, and Oso Flaco Creek have designated beneficial uses in the Basin Plan. The beneficial uses cited in the Basin Plan are listed in Table 2. Staff interprets Orcutt Creek as being synonymous with Orcutt-Solomon Creek.

The Basin Plan also states that surface water bodies within the region that do not have beneficial uses specifically designated for them are assigned the beneficial uses of “municipal and domestic water supply” and “protection of both recreation and aquatic life.” Staff interpreted this general statement of beneficial uses to encompass the following beneficial uses as defined in Table 2: REC-1, REC-2, MUN, and WARM. Blosser Channel, Bradley Canyon Creek, Bradley Channel, Main Street Canal, Nipomo Creek, and Little Oso Flaco Creek were not specifically listed in the Basin Plan and therefore were considered designated with those beneficial uses.

Table 2. Beneficial Uses for the Cuyama River, Alamo Creek, Santa Maria River, Santa Maria Estuary, Orcutt Creek and Oso Flaco Creek.

Water body	Cuyama River*	Alamo Creek	Santa Maria River	Santa Maria Estuary	Orcutt Creek	Oso Flaco Creek
Municipal and Domestic Supply (MUN)	X	X	X		X	X
Agricultural Supply (AGR)	X	X	X		X	X
Industrial Process Supply (PROC)	X					
Industrial Service Supply (IND)	X		X			
Ground Water Recharge (GWR)	X	X	X	X	X	X
Water Contact Recreation (REC-1)	X	X	X	X	X	X
Non-Contact Water Recreation (REC-2)	X	X	X	X	X	X
Wildlife Habitat (WILD)	X	X	X	X	X	X

Cold Fresh Water Habitat (COLD)	X	X	X		X	
Warm Fresh Water Habitat (WARM)	X	X	X	X		X
Migration of Aquatic Organisms (MIGR)			X	X		
Spawning, Reproduction, and/or Early Development (SPWN)	X	X		X		
Preservation of Biological Habitats of Special Significance (BIOL)				X		X
Rare, Threatened, or Endangered Species (RARE)	X	X	X	X	X	X
Estuarine Habitat (EST)				X	X	
Freshwater Replenishment (FRSH)	X		X		X	X
Commercial and Sport Fishing (COMM)	X	X	X	X	X	X
Shellfish Harvesting (SHELL)				X		

upstream of Twitchell Reservoir

2.2 Problem Statement

Oso Flaco Creek, the Santa Maria River and listed tributaries and drainages are on the 2002 Clean Water Act (CWA) Section 303(d) List of Water Quality Limited Segments (the 303(d) list) because bacteria levels exceeded the fecal coliform water quality objective for water contact recreation. Table 1 shows the listed waterbodies.

The Cuyama River, Main Street Canal, and Little Oso Flaco Creek are not currently listed but are impaired; Water Board staff will propose these water bodies for listing in 2008, and concluded they should also be assigned TMDLs at this time. Water Board staff previously used water quality data collected by the Central Coast Ambient Monitoring Program (CCAMP) to recommend inclusion on the 303(d) list. The results of more recent CCAMP data collection, along with additional data collected in these watersheds are discussed in Section 4 *Data Analysis*.

This report primarily addresses exceedances of the fecal coliform objective for recreation. This report also addresses exceedances of the total coliform objective for shellfish harvesting in the Santa Maria Estuary. Although this waterbody is not currently listed on the 303(d) list, it is a direct downstream receiving waterbody of the Santa Maria River. In December 2007, staff concluded is should be included as part of this project.

Staff researched the presence of shellfish harvesting (e.g., clams, oysters, and mussels) in the Santa Maria River Estuary, and found that clams have been harvested in the surf zone historically by the Chumash. Their diet consisted largely of seafood and shellfish and their discarded piles of shells, termed "shell middens," can be seen on the Guadalupe-Nipomo Dunes (http://santalucia.sierraclub.org/osoflaco.html). Shellfish harvesting also occurred in present times, with documentation of harvesting of sand crabs for human consumption on the north side of the estuary. Additionally, staff found that while there is no record of shellfish harvesting directly in the estuary itself in present times, there is potential for a more prevalent occurrence of these activities. Discharges from the Santa Maria River exceed the total coliform water quality criteria for shellfish harvesting and as such, adversely impacted this beneficial use as the estuary is a direct downstream receiving water body. Staff concluded that the shellfish harvesting beneficial use in the estuary would be impacted by elevated total coliform levels.

3 NUMERIC TARGETS

The Basin Plan contains numeric total and fecal coliform water quality objectives as well as waste discharge prohibitions that address these waterbodies and the pollutants of concern.

3.1 Water Quality Objectives

Two water quality objectives are in place to protect the water contact recreation beneficial use. The most stringent water quality objectives for total and fecal coliform applies to the water contact recreation (REC-1) and shellfish (SHELL) beneficial uses. The Basin Plan contains the following REC-1 and SHELL bacteria objectives for inland surface waters, enclosed bays and estuaries:

> *"Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200/100 mL, nor shall more than ten percent of total samples during any 30-day period exceed 400/100 mL."*
>
> *"At all areas where shellfish may be harvested for human consumption, the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70/100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230/100 ml for a five-tube decimal dilution test or 330/100 ml when a three-tube decimal dilution test is used."*

Often, available datasets do not contain five samples in a 30-day period, so the portion of the objective that is evaluated is that "no more than ten percent of total samples during any 30-day period exceed 400/100 mL." In instances where fewer than five samples were collected in 30 days, the "ten percent" threshold is exceeded if any one sample exceeds 400/100 mL.

At the time of writing of this report, State Board staff was reviewing *E. coli* bacterial indicator criteria recommendations as appropriate to the level of recreational use. While Water Board staff did not propose numeric targets for *E. coli*, Water Board staff evaluated *E. coli* data described in this report. *E.coli* criteria and analyses are discussed in the following section.

The proposed total and fecal coliform targets for this project are consistent with the current water quality objectives in the Basin Plan for total and fecal coliform.

The Basin Plan also contains a waste discharge prohibition adopted by the Central Coast Water Board in 1975. The prohibition states, "*Waste discharges to the following inland waters are prohibited: All surface freshwater impoundments and their immediate tributaries... The Santa Maria River downstream from the Highway One bridge*." Staff does not recommend changes to this prohibition.

4. DATA ANALYSIS

4.1 Background on fecal indicator bacteria

Ambient water quality assessments for fecal coliform rely principally on analysis of total and fecal coliform bacteria in grab samples. The total coliform group of bacteria is from the family, *Enterobacteriaceae*, which includes over 40 genera of bacteria. Bacteria of both fecal and non-fecal origin are included in the total coliform group. Common habitats for the group include soil, groundwater, surface water, the intestinal tract of animals and humans, the surface of plants, algal-mats in pristine streams, wastes from the wood industry, and biofilms within drinking water distribution systems (Hurst, et al., 2002). The total coliforms can be divided into various groups based on common characteristics. Among these, the fecal coliforms are generally indicative of fecal sources, though not all members of the group are of fecal origin (Hager, et al, 2004, p. 6). The bacteria species, *Escherichia coli (E. coli)*, comprises a large percentage of coliform detected in human and animal feces. Some strains of *E. coli* are pathogenic (e.g. the O157:H7 species) and some are not.

Analysis of water samples to detect the presence of fecal coliform and/or *E. coli* is one way to determine the potential presence of pathogens. However, analytical methods for quantifying bacteria lack the precision common to many laboratory methods for water quality analysis. For example, the Multiple Tube Fermentation[2] method results in an estimate of the most probable number (MPN) of bacteria. This number varies considerably and for a given result of 1,600 MPN/100mL for example, the 95% confidence limit ranges from 600 to 5,300 MPN/100mL. The other common method, Membrane Filtration, also has limitations, such as potentially under representing the concentration of coliform, particularly with highly turbid samples. In spite of these analytical limitations, testing for fecal coliform and/or *E. coli*, regardless of the analytical method used, is one of the best available methods to indicate potential fecal contamination (Hager, p. 7).

There are various methods available to differentiate sources of fecal waste. All methods have demonstrated drawbacks. Nevertheless, genetic methods of microbial source tracking are considered one of the best ways available to confirm presence of specific animal sources of *E. coli.* Water Board staff has successfully used genetic data in multiple watersheds to determine sources and identify and prioritize implementation actions. These methods however, are expensive and time-consuming, especially if multiple water bodies are in question. Furthermore, in watersheds where there is a mosaic of land uses, conducting a microbial source tracking study of receiving water may not provide definitive source identification because different animal sources can originate from multiple land uses. For example, *E. coli* from humans can originate from multiple sources and land uses (e.g. septic tanks in rural residential areas, leaking sewer system laterals in urban areas). As such, confirming the presence of specific sources determined by genetic methods may not change the approach to solving the problem in watersheds where there are multiple land uses.

[2] when referring to Multiple Tube Fermentation, staff is including both the conventional multiple tube method and IDEXX's colilert trays.

4.2 Data types and criteria used to evaluate impairment

Staff used several threshold values to evaluate data in the Section 4 *Data Analysis.* These were based on existing water quality objectives, as well as other recommended criteria, including the US Environmental Protection Agency's (EPA's) bacterial indicator criteria for *E. coli* as follows:

EPA Bacterial Indicator Criteria Recommendation

Indicator	Geometric Mean Density (per 100 mL)	Single Sample Maximum Allowable Density (per 100 mL)[a]			
		Designated Beach Area (75^{th} percentile)	**Moderate Full Body Contact Recreation (82^{nd} percentile)**	**Lightly Used Full Body Contact Recreation (90^{th} percentile)**	**Infrequently Used Full Body Contact Recreation (95^{th} percentile)**
E. coli	126[b]	235	298	409	575

Source: U.S. EPA (1986).
a. Calculated using the following: single sample maximum = geometric mean * 10^(confidence level factor * log standard deviation), where the confidence level factor is: 75%: 0.675; 82%: 0.935; 90%: 1.28; 95%: 1.65. The log standard deviation from EPA's epidemiological studies is 0.4 for fresh waters.
b. Calculated to nearest whole number using equation: geometric mean = antilog_{10} [(risk level + 11.74) / 9.40].

EPA recommended *E.coli* as a better indicator than fecal coliform. Following epidemiological studies conducted by EPA that evaluated the use of several organisms as indicators, including fecal coliforms and *E. coli*, EPA recommended in 1986 the use of *E. coli* for fresh recreational waters because they were better (emphasis added) predictors of acute gastrointestinal illness than fecal coliforms (United States Environmental Protection Agency, *Ambient Water Quality Criteria for Bacteria-1986*, January 1986).

Staff used the log mean of 126 MPN/100mL and the single sample values of 235 MPN/100mL, 409 MPN/100mL, and 575 MPN/100mL to evaluate *E. coli* data, and the water quality objective of 400MPN/100mL to evaluate fecal coliform data presented in this section.

Staff did not have genetic data available for analysis in these watersheds. However, staff reviewed microbial source tracking results from assessments in other watersheds and drew parallels between the other watersheds and Santa Maria and Oso Flaco watersheds (see Section 4.7 Relationship of Genetic Studies to Land Use).

Staff concluded that the Santa Maria and Oso Flaco watersheds had fecal coliform concentrations exceeding the water contact recreation water quality objectives and total coliform concentrations exceeding the shellfish harvesting water quality objectives, where the Basin Plan designates these respective uses. In the following data analysis, staff identified where and to what degree the problem occurred. In a subsequent section, *Source Analysis*, staff discussed the results of sampling and analysis aimed at tracking the source of the problem.

4.3 Sources of Data and Information Evaluated

Staff relied on data collected by the following entities or programs in preparing this report:

- Central Coast Ambient Monitoring Program (CCAMP),
- Water Board TMDL Program,
- City of Santa Maria,
- County of Santa Barbara's Project Clearwater,
- Morro Bay National Monitoring Program,
- United States Geological Survey flow data,
- Geographic Information System analysis of land uses, and
- Genetic studies.

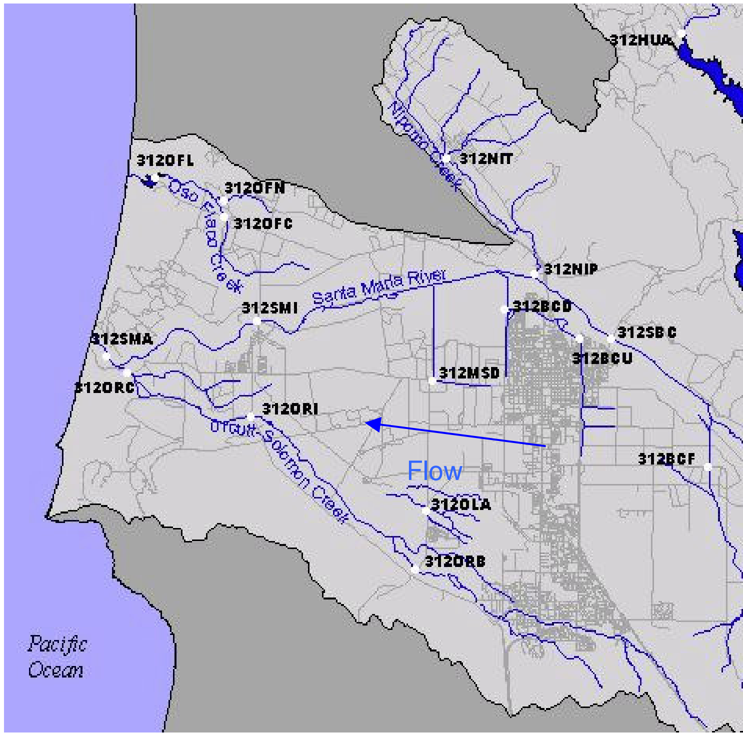
The following discussion summarizes the monitoring activities and results from these efforts.

4.4 Water Quality Data and Analysis

4.4.1 Central Coast Ambient Monitoring Program

The Water Board's CCAMP staff conducted monthly total and fecal coliform monitoring from 2000 to 2001 and from 2007 to 2008. Staff conducted additional monthly water quality monitoring at the Santa Maria River at Rancho Guadalupe Dunes Preserve site continuously between these dates. Figure 2 and Figure 3 show the locations of the watersheds and major water bodies. A small tributary, Little Oso Flaco Creek (not shown in Figure 2) drains to Oso Flaco Creek from the east. Main, Blosser, and Bradley Channels, and Bradley Canyon Creek (also not shown in Figure 2) flow into the Santa Maria River, and ultimately into the Santa Maria Estuary from the south. While all CCAMP site locations are shown in the figures, not all are impaired nor are discussed in this report. Table 3 shows the names of the sampling sites. Impaired water bodies are shown in Table 4.

Figure 2. CCAMP Monitoring Locations in the Lower Santa Maria Watershed and Oso Flaco Watershed.



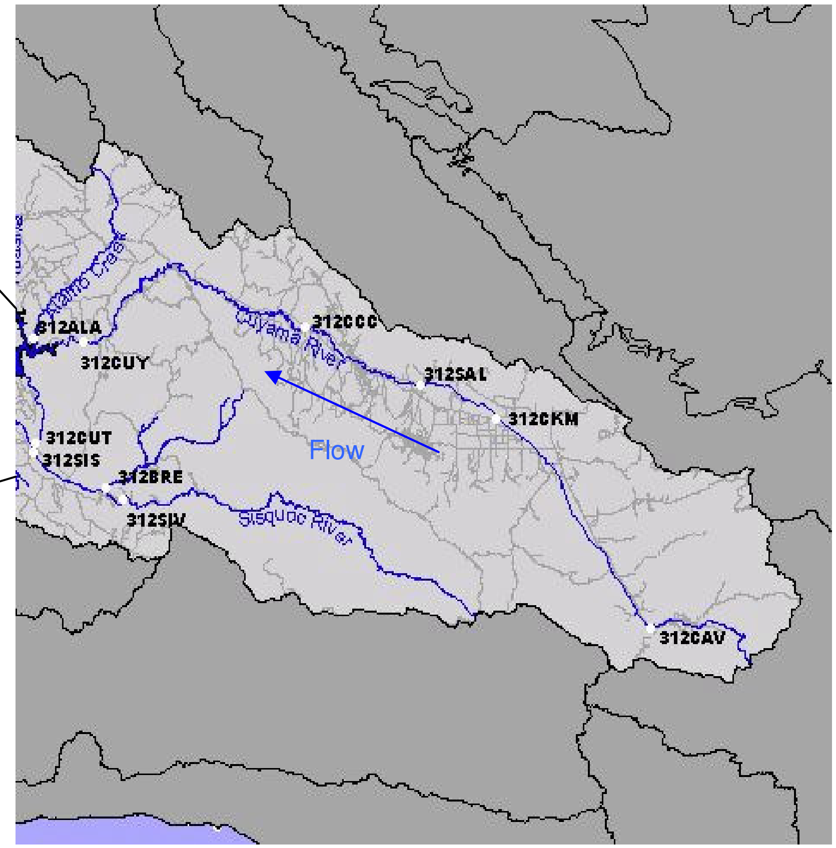


Figure 3. CCAMP Monitoring Locations in the Cuyama River and Upper Santa Maria Watersheds.

Table 3. CCAMP Monitoring Locations in the Cuyama, Santa Maria, Orcutt-Solomon, and Oso Flaco Watersheds.

Water Body	Site Name	Site Location
Alamo Creek	312ALA	312ALA-Alamo Creek at Alamo Creek Road
Blosser Channel	312BCD	312BCD-Blosser Channel d/s of groundwater recharge ponds
Bradley Canyon Creek	312BCF	312BCF-Bradley Canyon diversion channel @ Foxen Canyon Road
Bradley Channel	312BCU	312BCU-Bradley Channel u/s of ponds @ Magellan Drive
LaBrea Creek	312BRE	312BRE-LaBrea Creek u/s Sisquoc River
Cuyama River(above res.)	312CAV	312CAV-Cuyama River @ Highway 33
Cuyama River(above res.)	312CCC	312CCC-Cuyama River d/s Cottonwood Canyon
Cuyama River(above res.)	312CUL	312CUL-Cuyama River above Lockwood turnoff
Cuyama River(below res.)	312CUT	312CUT-Cuyama River below Twitchell @ White Rock Lane
Cuyama River(above res.)	312CUY	312CUY-Cuyama River d/s Buckhorn Road
Huasna River	312HUA	312HUA-Husana River @ Huasna Townsite Road
Main Street Canal	312MSD	312MSD-Main Street Canal u/s Ray Road @ Highway 166
Nipomo Creek	312NIP	312NIP-Nipomo Creek @ Highway 166
Nipomo Creek	312NIT	312NIT-Nipomo Creek @ Tefft Street
Oso Flaco Creek	312OFC	312OFC-Oso Flaco Creek @ Oso Flaco Lake Road
Oso Flaco Lake	312OFL	312OFL-Oso Flaco Lake @ culvert
Little Oso Flaco Creek	312OFN	312OFN-Little Oso Flaco Creek
Betteravia Lakes	312OLA	312OLA-Betteravia Lakes at Black Road
Orcutt Solomon Creek	312ORB	312ORB-Orcutt Solomon Creek @ Black Road
Orcutt Solomon Creek	312ORC	312ORC-Orcutt Solomon Creek u/s Santa Maria River
Orcutt Solomon Creek	312ORI	312ORI-Orcutt Solomon Creek @ Highway 1
Salisbury Creek	312SAL	312SAL-Salisbury Creek @ Branch Canyon Wash
Santa Maria River	312SBC	312SBC-Santa Maria River @ Bull Canyon Road
Sisquoc River	312SIS	312SIS-Sisquoc River @ Santa Maria Way
Sisquoc River	312SIV	312SIV-Sisquoc River u/s Tepusquet Road
Santa Maria River	312SMA	312SMA-Santa Maria River @ Rancho Guadalupe Dunes Preserve
Santa Maria River	312SMI	312SMI-Santa Maria River @ Highway 1

Staff summarized available data collected in impaired waterbodies during the 2000-01 and 2007-08 CCAMP sampling rotations. Descriptive statistics are shown in Table 4. Levels of fecal coliform exceeded the water quality objective protective of human contact recreation at all sites, and levels of total coliform exceeded the water quality objective protective of shellfish harvesting 100% of the time in the Santa Maria Estuary.

Table 4. Percent Exceedances and Water Quality Monitoring sites in Listed Water Bodies in the Cuyama, Santa Maria, Oso Flaco Creek Watersheds in 2000-01 and 2007-08.

Water body	**Site**	**Number of samples**	**Min. (MPN)**	**Log mean (MPN)**	**Max. (MPN)**	**Percent exceedance of Fecal Coliform 400 MPN/100mL**
Oso Flaco Creek (including Little Oso Flaco Creek)	312OFC 312OFN	51	ND	208	35000	39%
Alamo Creek	312ALA	25	23	275	5000	44%
Cuyama River*	312CUY, 312CCC	25	ND	333	3580	48%
Nipomo Creek	312NIT, 312NIP	41	10	698	9000	59%
Santa Maria River	312SMA, 312SMI	73	ND	820	24000	71%
Blosser Channel	312BCD	19	14	669	30000	58%
Main Street Canal	312MSD, 312MSS	35	10	1131	28000	74%
Bradley Channel	312BCU	23	30	576	13000	52%
Bradley Canyon Creek	312BCF	8	110	3115	160001	75%
Orcutt-Solomon Creek	312ORC, 312ORI, 312ORB	79	20	809	90000	68%
4.4.1.1.1 Water body	**Site**	**Number of samples**	**Min. (MPN)**	**Median (MPN)**	**Max. (MPN)**	**Percent exceedance of Total Coliform 230 MPN/100mL**
Santa Maria Estuary	312SMA	56	800	24000	160001	100%

*2007-08 sampling rotation data not available.

Staff evaluated CCAMP water quality data collected on each listed water body. These data, along with field observations and general land use activities are presented below. The estimated percentages of each land use in each watershed are discussed in more detail in the *Land Use Data* Section, and sources are described in more detail in the *Source Analysis* Section. Staff displayed CCAMP data using time series graphs and/or a Standard-Exceedances Evaluation depending on the data analysis tools and amount of data available.

Cuyama River and Alamo Creek
CCAMP staff collected samples on the Cuyama River at sites upstream and downstream of Twitchell Reservoir between January 2000 and April 2001 (CCAMP sites are shown in Table 3). Staff evaluated data collected on the Cuyama River; concentrations from three sites are shown in Figure 4. Figure 4 displays one year of data (first CCAMP rotation) in order to compare sites on the Cuyama River. The monitoring sites at Cottonwood Canyon (312CCC) and Buckhorn Road (312CUY) are upstream of Twitchell Reservoir, and the site Twitchell Reservoir (312CUT) is below Twitchell Reservoir, upstream of the confluence with the Sisquoc River. Fecal coliform levels at 312CCC and 312CUY were higher than those measured downstream at an unimpaired site, 312CUT (not included in Table 4). Staff considered the reaches upstream of the reservoir at Cottonwood Canyon (312CCC) and Buckhorn Road (312CUY) as impaired year-round. Staff concluded the reaches upstream of Salisbury Creek @ Branch Canyon Wash (312SAL) and downstream of the reservoir at 312CUT as not impaired.

Water Board staff observed that the likely sources of the impairment were activities occurring on rangeland, the primary manageable or *controllable* land use in this watershed.

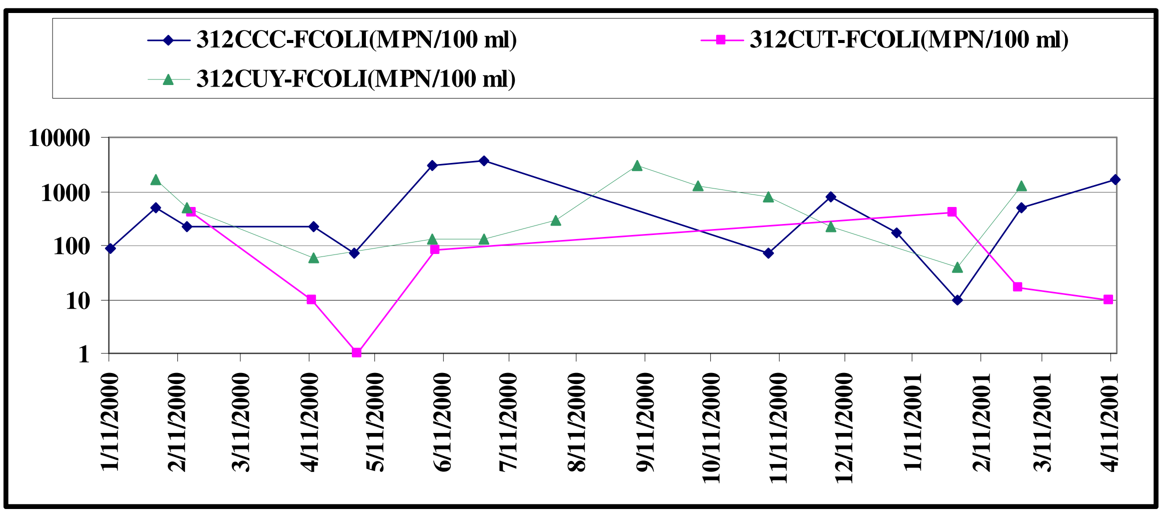


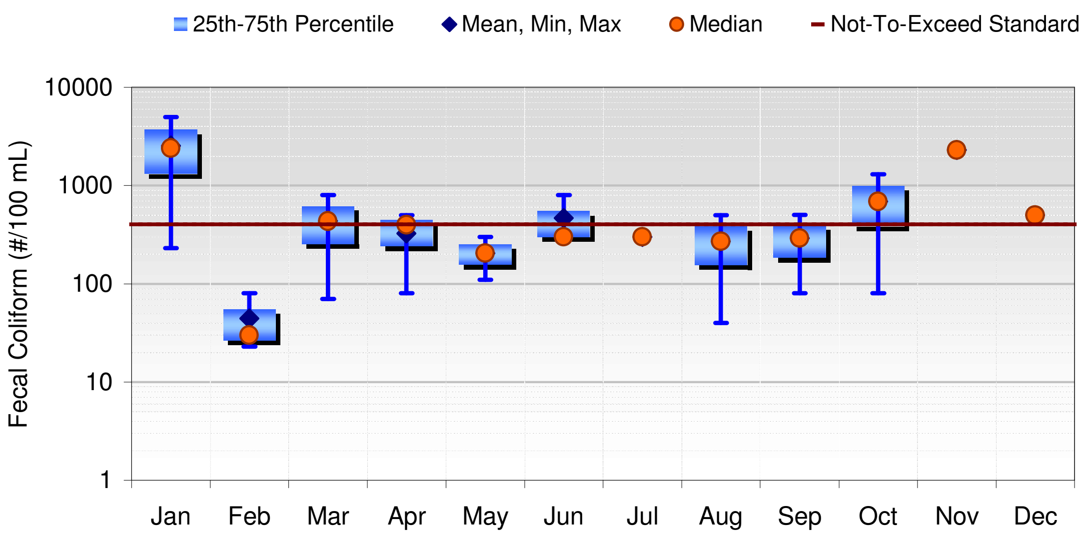
Figure 4. Fecal Coliform Log Means on the Cuyama River Downstream of Cottonwood Canyon (312CCC), Downstream of Buckhorn Road (312CUY), and Below Twitchell Reservoir (312CUT), January 2000 to February 2001.

CCAMP staff collected samples on Alamo Creek, a tributary to the Cuyama River, at Highway 166 (312ALA). CCAMP sites are shown in Table 3. Figure 5 displays a standard-exceedance assessment, which includes a monthly analysis of summary statistics (e.g. median) when multiple monthly data points are available, 25^{th} – 75^{th} percentile, and exceedance amount, along with the water contact water quality objective of 400 MPN/100 mL. The standard-exceedance assessments are included to display seasonal trends. Single sample values are displayed as a median when only one monthly value is available. Levels measured in 2000-01 were slightly higher than those found in 2007-08.

Fecal coliform concentrations were elevated year-round, with highest levels occurring during what is generally the wet season (September through January). Staff concluded this site was impaired. During most field visits, CCAMP staff observed cattle in the creek or evidence of cattle present (e.g. hoof prints, waste) in the creek.

In an analysis of water quality and land use data, Water Board staff concluded the likely source of the impairment was activities occurring on rangeland, the primary manageable land use in this watershed.

Standard-Exceedence Assessment



Summary Statistics (Data: 2/1/2000 2:30:00 PM to 10/31/2007 12:01:00 PM)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	2543	2400	230	5000	1315	3700	2:3	67%
Feb	44	30	23	80	27	55	0:3	0%
Mar	435	435	70	800	253	618	1:2	50%
Apr	327	400	80	500	240	450	1:3	33%
May	205	205	110	300	158	253	0:2	0%
Jun	467	300	300	800	300	550	1:3	33%
Jul	300	300	300	300	300	300	0:1	0%
Aug	270	270	40	500	155	385	1:2	50%
Sep	292	292	80	503	186	397	1:2	50%
Oct	690	690	80	1300	385	995	1:2	50%
Nov	2300	2300	2300	2300	2300	2300	1:1	100%
Dec	500	500	500	500	500	500	1:1	100%
All Data	**681**	**300**	**23**	**5000**	**80**	**503**	**10:25**	**40%**

Figure 5. Monthly Fecal Coliform Exceedances on Alamo Creek at Highway 166 (312ALA) February 2000 to October 2007.

Nipomo Creek

CCAMP staff collected samples at two sites (312NIP and 312NIT) on Nipomo Creek. Log mean concentrations of fecal coliform at both sites during the first CCAMP rotation are displayed in Figure 6 and combined monthly exceedances for both years are shown in Figure 7. The maximum water quality objective of 400 MPN/100mL is also shown.

Concentrations measured upstream at Tefft Street (312NIT) were typically higher and more variable than those measured downstream on Nipomo Creek at Highway 166 (312NIP). The mean exceeded the maximum water quality objective at both sites every month (Figure 7). Fecal coliform levels were more variable during the wet season than during the dry season.

In an analysis of land use data, Water Board staff determined that Nipomo Creek drained a variety of land uses that included numerous potential sources. Land uses upstream of Tefft Street (312NIT) included irrigated agriculture (e.g. row crops, nurseries), rangeland, urban areas, and rural residential properties with livestock (e.g. horses, pigs) and potentially failing septic systems. Natural sources included birds and wildlife. CCAMP staff often observed swallows nesting above the creek throughout the dry season at this particular monitoring site, 312NIP.

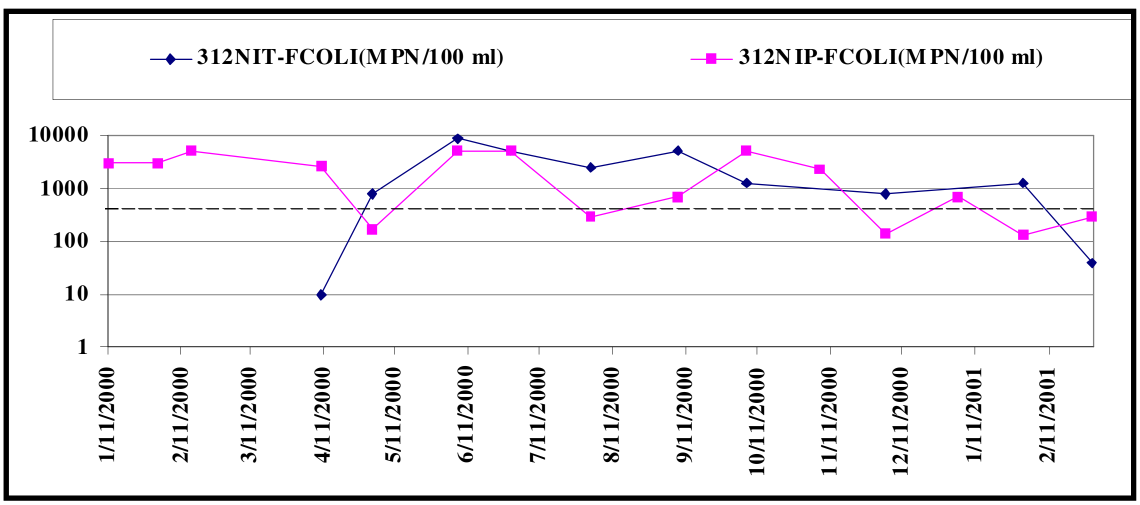
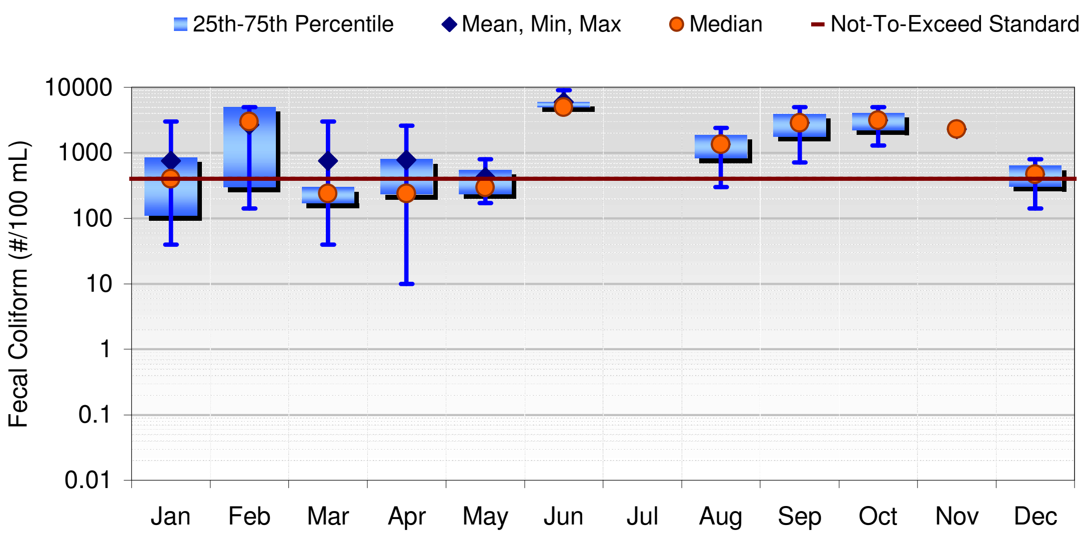


Figure 6. Fecal Coliform Log Means on Nipomo Creek at Tefft Street (312NIT) and Nipomo Creek at Highway 166 (312NIP) January 2000 to February 2001.

Standard-Exceedence Assessment



Summary Statistics (Data: 1/11/2000 2:30:00 PM to 5/30/2007 1:21:00 PM)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	753	400	40	3000	110	850	4:8	50%
Feb	2688	3000	140	5000	300	5000	3:5	60%
Mar	750	240	40	3000	170	300	1:5	20%
Apr	776	240	10	2600	230	800	2:5	40%
May	423	300	170	800	235	550	1:3	33%
Jun	6000	5000	5000	9000	5000	6000	4:4	100%
Jul	0	0	0	0	0	0	0:0	n/a
Aug	1350	1350	300	2400	825	1875	1:2	50%
Sep	2855	2855	710	5000	1783	3928	2:2	100%
Oct	3150	3150	1300	5000	2225	4075	2:2	100%
Nov	2300	2300	2300	2300	2300	2300	1:1	100%
Dec	470	470	140	800	305	635	1:2	50%
All Data	**1803**	**710**	**10**	**9000**	**235**	**3000**	**22:39**	**56%**

Figure 7. Monthly Fecal Coliform Exceedances on Nipomo Creek at Tefft Street (312NIT) and Nipomo Creek at Highway 166 (312NIP) January 2000 to May 2007.

Santa Maria River and Estuary

CCAMP staff collected samples in the Santa Maria River at Highway 1 (312SMI) and further downstream at Rancho Guadalupe Dunes Preserve Road (312SMA) between January 2000 and February 2001. Sampling at SMA is continuous on a monthly basis through CCAMP's Coastal Confluences project; data for this site is shown from January 2000 through August 2004 in Figure 8.

Staff also evaluated total coliform data collected on the Santa Maria River directly upstream of the estuary at the Rancho Guadalupe Dunes Preserve Road (312SMA) between January 2000 and August 2004. Total coliform exceedances of the shellfish harvesting water quality objective were found 100% of the time (Table 4). Total coliform levels were elevated year-round. Cattle graze directly in and adjacent to the Estuary.

Fecal coliform concentrations found at 312SMA were higher than those found upstream at 312SMI during 2000-01, with log means of 804 MPN/100 mL and 618 MPN/100 mL respectively. Results of a standard exceedance assessment at both sites are displayed in Figure 9.

Fecal coliform concentrations along the Santa Maria River were variable year-round with levels higher during what is generally the dry season (April-October), although exceedances were found during every month of the year. During every field visit, CCAMP staff observed cattle in the creek or evidence of cattle present (e.g. hoof prints, waste).

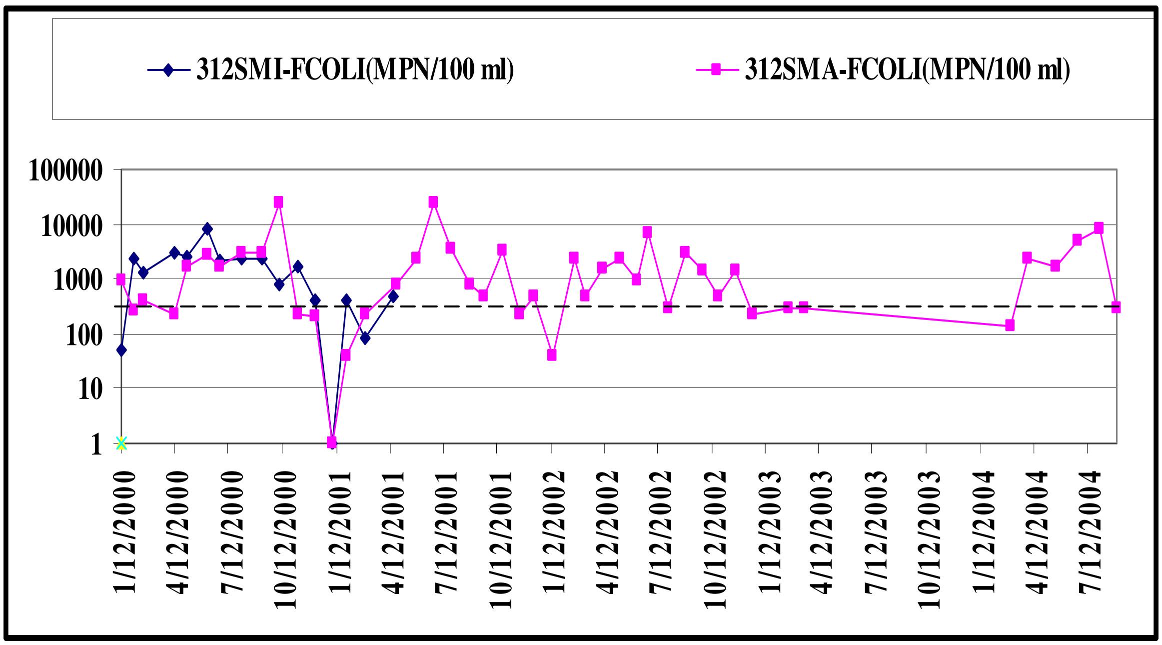
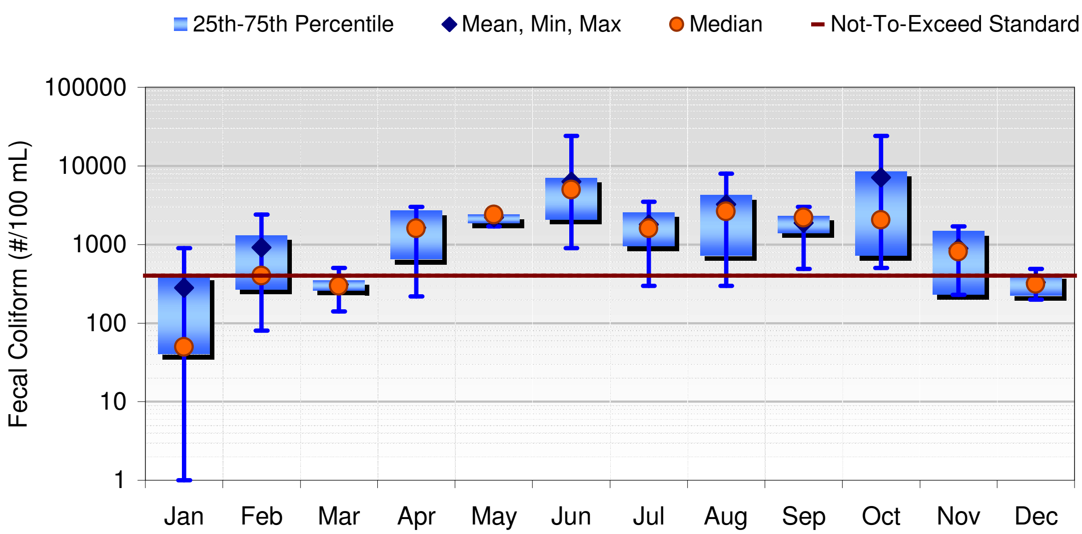


Figure 8. Fecal Coliform Log Means in the Santa Maria River at Highway 1 (312SMI) and Santa Maria River at Rancho Guadalupe Dunes Preserve Road (312SMA) January 2000 to February 2001.

Standard-Exceedence Assessment



Summary Statistics (Data: 1/12/2000 1:15:00 PM to 9/26/2007 11:00:00 AM)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	281	50	1	900	40	400	2:9	22%
Feb	920	400	80	2400	270	1300	4:9	44%
Mar	310	300	140	500	260	350	1:4	25%
Apr	1644	1600	220	3000	645	2700	6:7	86%
May	2200	2400	1700	2600	1875	2400	6:6	100%
Jun	6278	5000	900	24000	2100	7000	9:9	100%
Jul	1800	1600	300	3500	950	2550	2:3	67%
Aug	3236	2650	300	8000	718	4250	7:8	88%
Sep	1878	2200	490	3000	1400	2300	5:5	100%
Oct	7150	2050	500	24000	725	8475	4:4	100%
Nov	890	815	230	1700	230	1475	2:4	50%
Dec	330	315	200	490	223	423	1:4	25%
All Data	**2325**	**1100**	**1**	**24000**	**300**	**2400**	**49:72**	**68%**

Figure 9. Monthly Fecal Coliform Exceedances in the Santa Maria River at Highway 1 (312SMI) and Santa Maria River at Rancho Guadalupe Dunes Preserve Road (312SMA) January 2000 to September 2007.

Runoff from the City of Santa Maria drained to the Santa Maria River both directly and through a series of stormwater percolation ponds. Staff identified that the primary manageable land uses downstream of the City of Santa Maria in the lower reaches of the Santa Maria River were rangeland and urban land uses, and concluded that manageable activities occurring on these land uses were likely contributing to the impairment.

<u>Main Street, Blosser and Bradley Channels:</u>
CCAMP staff collected samples between January 2000 and February 2001 in Main Street Canal, and in Blosser Channel and Bradley Channel, two concrete stormwater conveyances. Bradley Channel drains to percolation ponds, and Blosser Channel and Main Street Canal drain to the Santa Maria River. Fecal coliform concentrations at both

sites are displayed in Figure 10 and results of a standard-exceedance assessment are shown in Figure 12. Levels in Main Street Canal (312MSD) and Blosser Channel at Rancho Verde (312BCD) were higher and more variable than those found in Bradley Channel at Magellan Drive (312BCU). Exceedances of the fecal coliform water quality objective were found throughout the year.

The Main Street Canal is downstream of the city limits and receives both agricultural and urban inputs. Blosser Channel was significantly modified in conjunction with adjacent urban development, and while this drainage still receives stormwater, it no longer receives year-round flow from adjacent stormwater ponds.

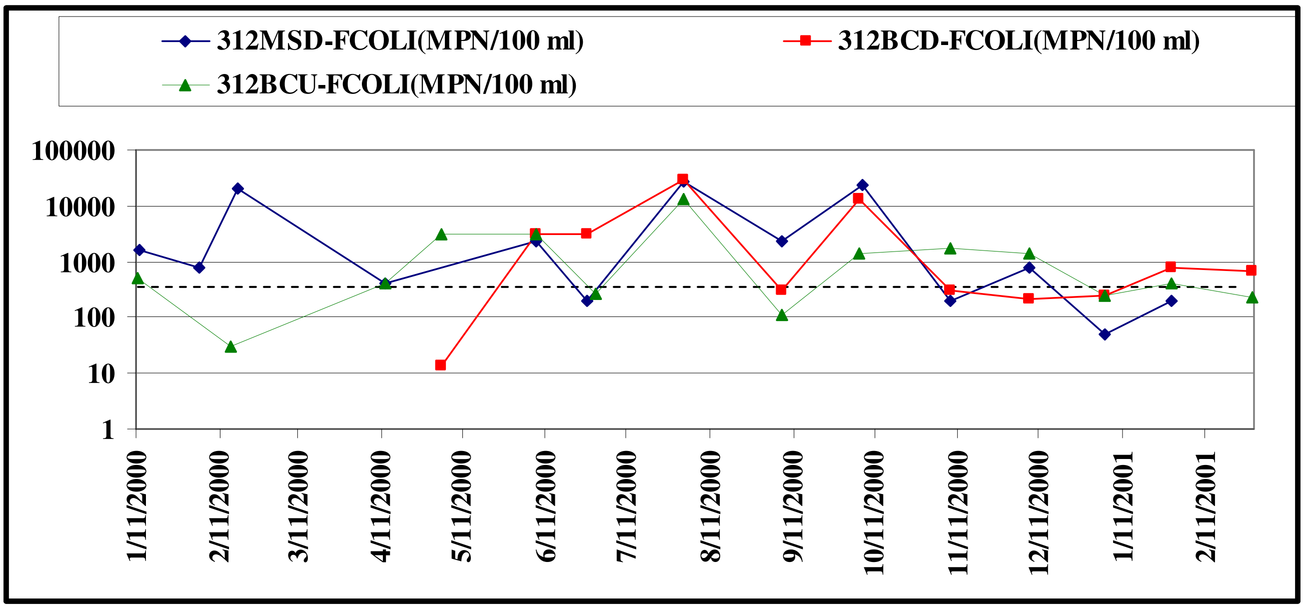
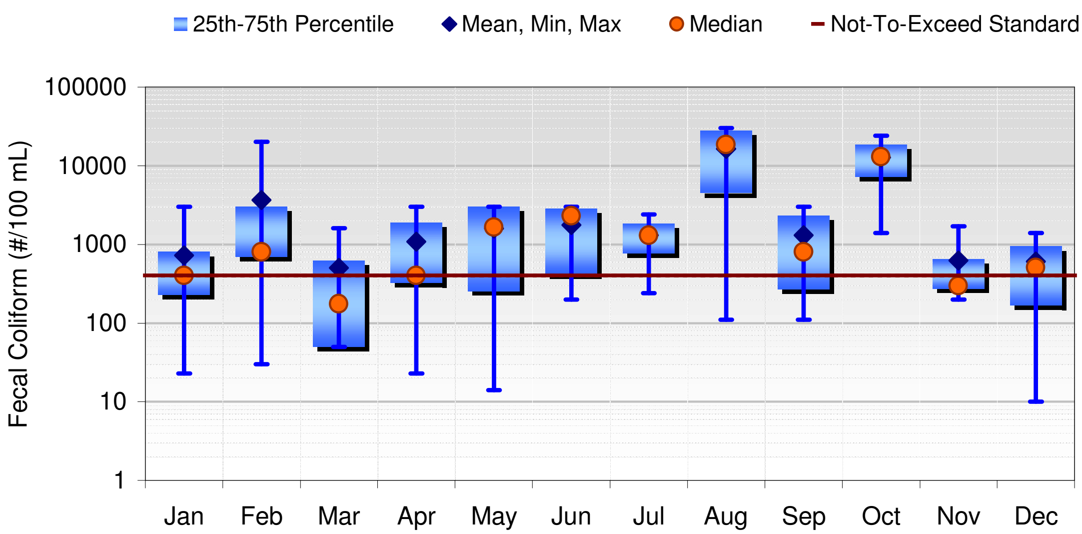


Figure 10. Fecal Coliform Log Means in Main Street Canal (312MSD), Blosser Channel at Rancho Verde (312BCD) and Bradley Channel at Magellan Drive (312BCU). January 2000 to February 2001.

Standard-Exceedence Assessment



Summary Statistics (Data: 1/11/2000 2:00:00 PM to 9/25/2007 2:21:00 PM)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	722	400	23	3000	230	800	5:13	38%
Feb	3662	800	30	20000	700	3000	7:9	78%
Mar	500	175	50	1600	50	625	1:4	25%
Apr	1087	400	23	3000	325	1900	2:6	33%
May	1592	1650	14	3000	255	3000	3:6	50%
Jun	1760	2300	200	3000	420	2850	7:10	70%
Jul	1313	1300	240	2400	770	1850	2:3	67%
Aug	16389	18500	110	30000	4500	28000	7:8	88%
Sep	1307	800	110	3000	270	2350	4:7	57%
Oct	12800	13000	1400	24000	7200	18500	3:3	100%
Nov	625	300	200	1700	275	650	1:4	25%
Dec	608	510	10	1400	168	950	2:4	50%
All Data	**3449**	**800**	**10**	**30000**	**240**	**3000**	**44:77**	**57%**

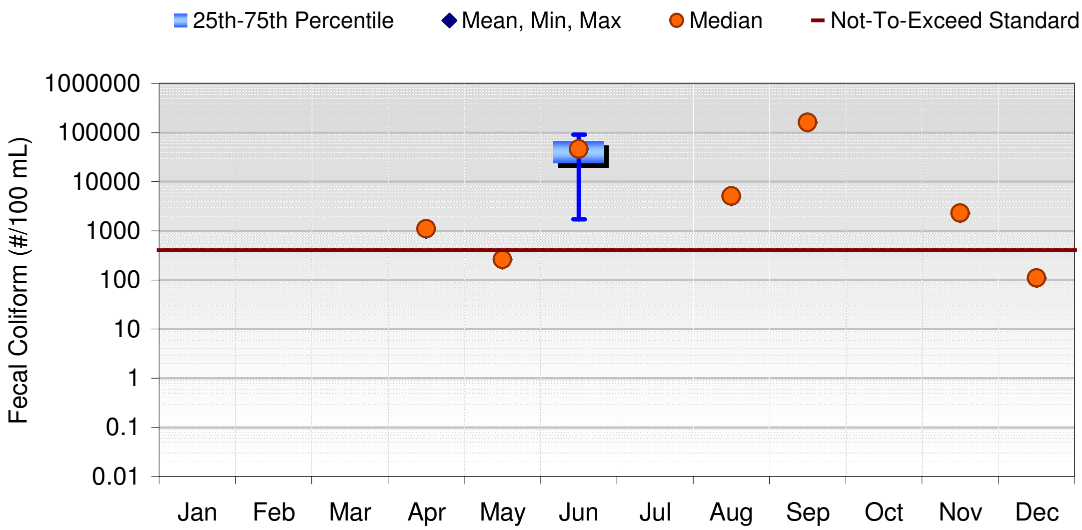
Figure 11. Monthly Fecal Coliform Exceedances in Main Street Canal (312MSD and 312MSS), Blosser Channel at Rancho Verde (312BCD) and Bradley Channel at Magellan Drive (312BCU), January 2000 to September 2007.

Bradley Canyon Creek

CCAMP staff collected a limited number of samples at Bradley Canyon Creek at Foxen Canyon Road (312BCF). Staff obtained several samples during the first sampling rotation between April and December 2000, and one sample in August 2007 during the second sampling rotation due to lack of flow. Monthly concentrations are shown in Figure 12. The figure displays single sample values as medians because with the exception of June, only one set of monthly values are available. Fecal coliform concentrations were elevated above water contact water quality objectives in April, June, August, September, and November with levels reaching 160,000 MPN/100 mL in September 2000 and 90,000 MPN/100mL in June 2000.

Possible sources included runoff from rangeland and rural residential properties (with livestock and/or septic systems). There is no riparian vegetation at or upstream of 312BCF. CCAMP staff attempted to sample upstream of 312BCF but was unable to gather a representative sample due to either lack of flow or flooding.

Standard-Exceedence Assessment



Summary Statistics (Data: 4/12/2000 10:35:00 AM to 8/29/2007 1:31:00 PM)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	0	0	0	0	0	0	0:0	n/a
Feb	0	0	0	0	0	0	0:0	n/a
Mar	0	0	0	0	0	0	0:0	n/a
Apr	1100	1100	1100	1100	1100	1100	1:1	100%
May	260	260	260	260	260	260	0:1	0%
Jun	45850	45850	1700	90000	23775	67925	2:2	100%
Jul	0	0	0	0	0	0	0:0	n/a
Aug	5000	5000	5000	5000	5000	5000	1:1	100%
Sep	160001	160001	160001	160001	160001	160001	1:1	100%
Oct	0	0	0	0	0	0	0:0	n/a
Nov	2300	2300	2300	2300	2300	2300	1:1	100%
Dec	110	110	110	110	110	110	0:1	0%
All Data	**32559**	**2000**	**110**	**160001**	**890**	**26250**	**6:8**	**75%**

Figure 12. Monthly Fecal Coliform Exceedances at Bradley Canyon Creek at Foxen Canyon Road (312BCF) April to August 2007.

<u>Orcutt-Solomon Creek</u>

CCAMP staff collected samples at Orcutt (Orcutt-Solomon) Creek between January 2000 and March 2001. Fecal coliform concentrations at three sites are displayed in Figure 13 and results of a standard-exceedance assessment are shown in Figure 14. Site 312ORI is the same as the County of Santa Barbara's Project Clean Water Site OR1 discussed in a subsequent section.

The most upstream site at Black Road (312ORB), a low flowing drainage, exhibited elevated levels year-round, with a log mean of 1,826 MPN/100 mL. Concentrations were more variable during what is generally the wet season, reaching 90,000 MPN/100 mL and 10,000 MPN/100 mL in January and November 2000. Concentrations were higher at the furthest downstream site, Rancho Guadalupe Dunes Preserve Road (312ORC) than upstream of that site at Highway 1 (312ORI), with log means of 794 MPN/100 mL and 300 MPN/100 mL respectively. Fecal coliform levels exceeded water quality objectives year-round.

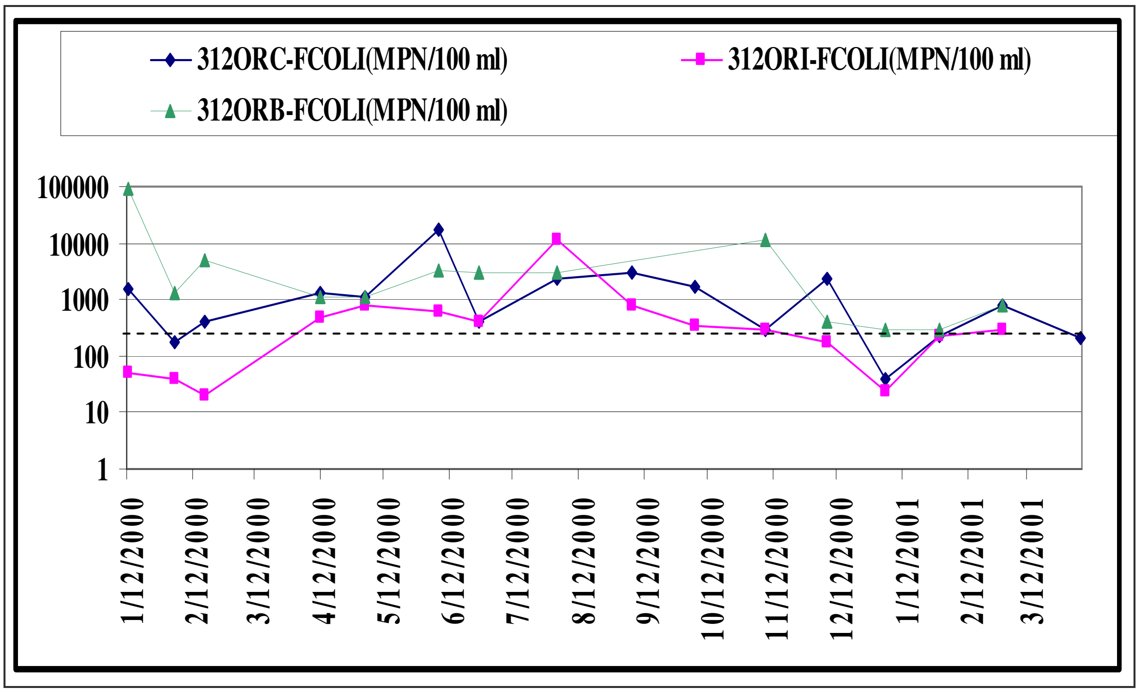
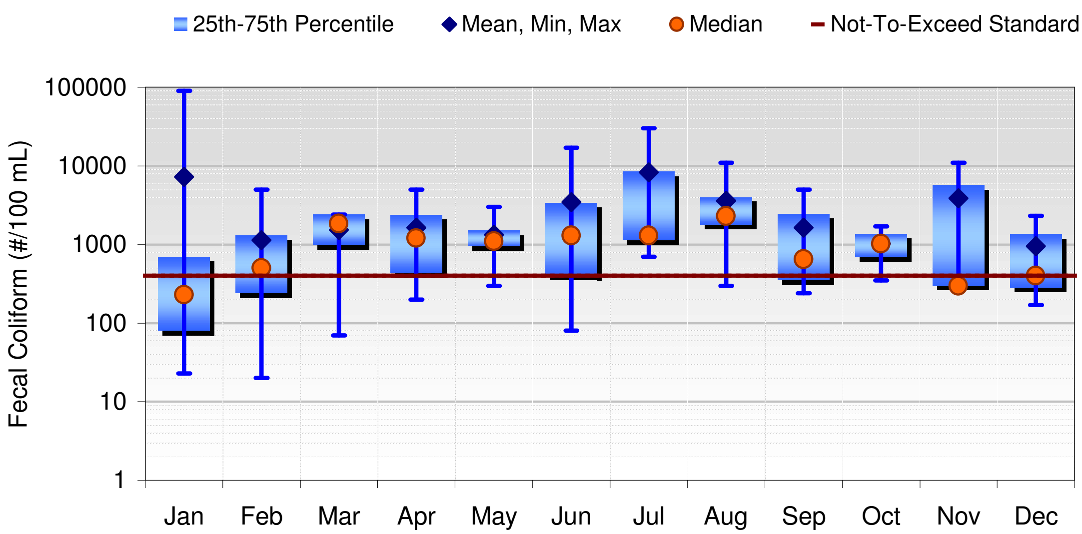


Figure 13. Fecal Coliform Log Means in Orcutt-Solomon Creek at 312ORC, 312ORI, and 312ORB January 2000 to March 2001.

Standard-Exceedence Assessment



Summary Statistics (Data: 1/12/2000 12:00:00 PM to 9/26/2007 1:33:00 PM)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	7271	230	23	90000	80	700	4:13	31%
Feb	1136	500	20	5000	240	1300	7:13	54%
Mar	1543	1850	70	2400	993	2400	3:4	75%
Apr	1643	1200	200	5000	435	2400	6:8	75%
May	1329	1100	300	3000	950	1500	6:7	86%
Jun	3464	1300	80	17000	400	3400	6:9	67%
Jul	8325	1300	700	30000	1150	8475	4:4	100%
Aug	3600	2300	300	11000	1800	4000	6:7	86%
Sep	1640	650	240	5000	350	2450	4:6	67%
Oct	1025	1025	350	1700	688	1363	1:2	50%
Nov	3867	300	300	11000	300	5650	1:3	33%
Dec	957	400	170	2300	285	1350	1:3	33%
All Data	**3214**	**800**	**20**	**90000**	**300**	**2350**	**49:79**	**62%**

Figure 14. Monthly Fecal Coliform Exceedances in Orcutt-Solomon Creek at 312ORC, 312ORI, and 312ORB January 2000 to September 2007.

Manageable land uses within the Orcutt-Solomon watershed included rangeland, urban, and rural residential with livestock (e.g. horses). Primarily irrigated agriculture and rangeland drained to Orcutt-Solomon Creek in between 312ORC and 312ORI; rangeland drained to 312ORB. Staff concluded that multiple land uses with various associated activities are likely causing the impairment in Orcutt-Solomon Creek.

Oso Flaco Creek and Little Oso Flaco Creek

CCAMP staff collected samples Oso Flaco Creek and Little Oso Flaco Creek. Fecal coliform levels in Oso Flaco Lake (312OFL) were below water contact water quality objectives, with the exception of two exceedances in Fall 2000. Oso Flaco Lake is not on the 303(d) list for fecal coliform because concentrations typically met water quality objectives.

Concentrations on Oso Flaco Creek at Oso Flaco Creek Road (312OFC) were elevated above water contact water quality objectives during what is generally the dry season, in May through October. Concentrations and seasonal trends at Little Oso Flaco Creek (312OFN) were similar, with levels reaching 23,000 MPN/100 mL in May 2000. Fecal coliform concentrations at Oso Flaco Creek and Little Oso Flaco Creek are displayed in Figure 15 and results of a standard-exceedance assessment are shown in Figure 16.

Little Oso Flaco Creek is not specifically listed as impaired on the 303(d) list. Staff concluded that both Oso Flaco Creek and its tributary, Little Oso Flaco Creek were impaired. As such, TMDLs were developed for both water bodies.

In an analysis of land uses, staff concluded that the primary land use within the Oso Flaco watershed was irrigated agriculture along with rural residential land uses. Staff also identified rural residential/urban land uses on the Nipomo Mesa that drain to the Oso Flaco watershed via a stormwater conveyance system and collected samples at this location, as discussed in the following Water Board TMDL monitoring section.

Staff found that the Nipomo Mesa did not discharge flow during the dry season, the time of impairment. Staff concluded that the Nipomo Mesa was not causing exceedances in Oso Flaco Creek, likely due to dilution. This is based on the evidence that while discharges during the wet season from the Nipomo Mesa were elevated above water quality objectives, fecal coliform levels in Oso Flaco Creek during the wet season were within water quality objectives.

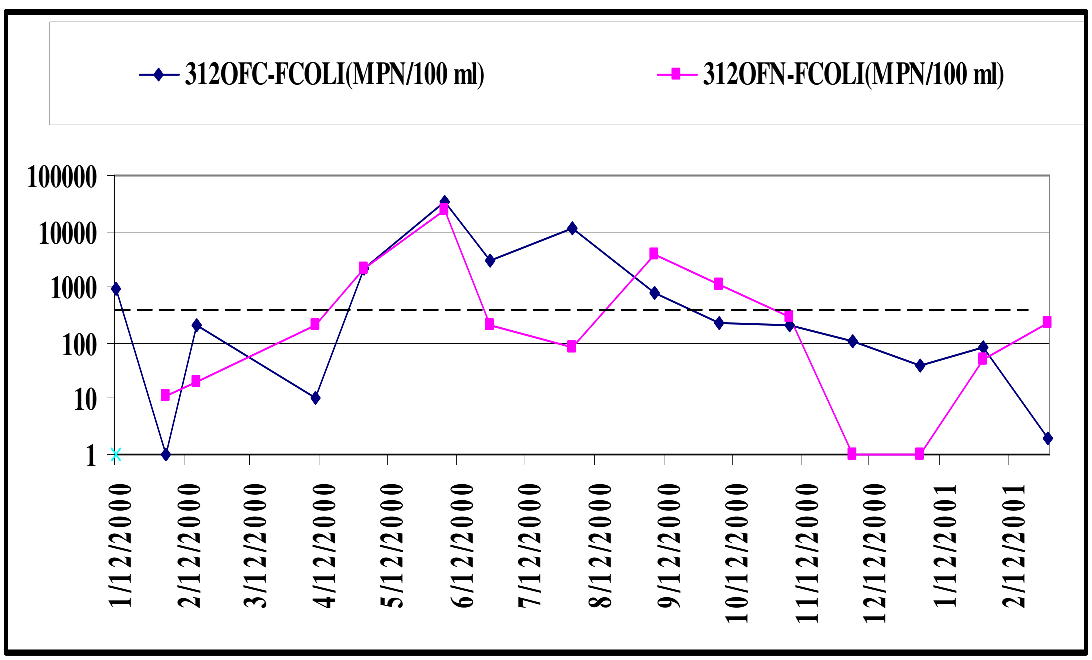
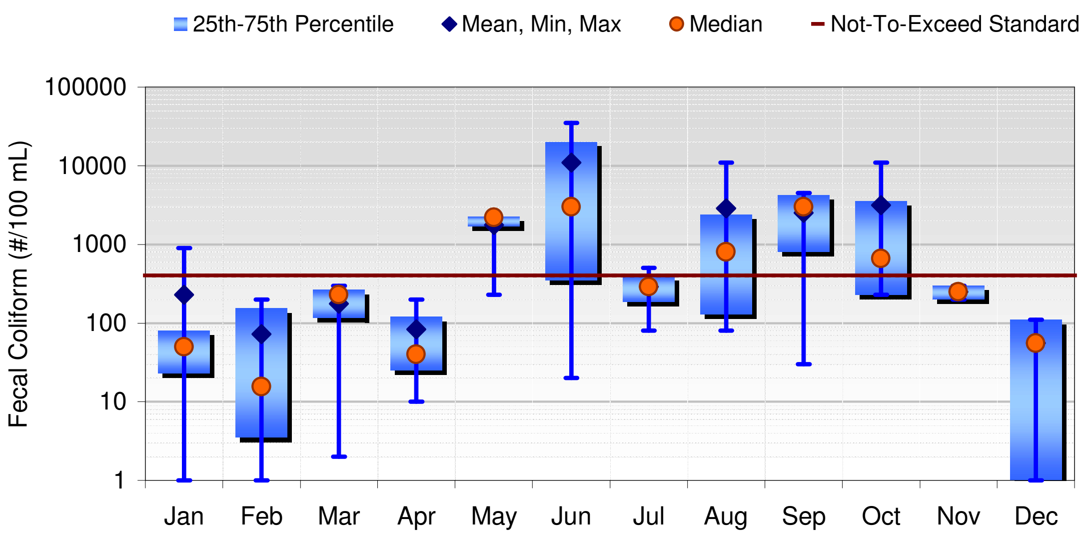


Figure 15. Fecal Coliform Log Means in Oso Flaco Creek (312OFC) and Little Oso Flaco Creek (312OFN) January 2000 to March 2001.

Standard-Exceedence Assessment



Summary Statistics (Data: 1/12/2000 2:15:00 PM to 9/26/2007 9:59:00 AM)								
Month	**Mean**	**Median**	**Min**	**Max**	**25th**	**75th**	**XS:Count**	**XS%**
Jan	231	50	1	900	23	80	2:9	22%
Feb	72	16	1	200	4	155	0:6	0%
Mar	177	230	2	300	116	265	0:3	0%
Apr	83	40	10	200	25	120	0:3	0%
May	1758	2200	230	2400	1708	2250	3:4	75%
Jun	11002	3000	20	35000	350	20250	7:10	70%
Jul	290	290	80	500	185	395	1:2	50%
Aug	2882	800	80	11000	130	2400	3:5	60%
Sep	2521	3000	30	4500	810	4250	6:7	86%
Oct	3140	665	230	11000	230	3575	2:4	50%
Nov	250	250	200	300	200	300	0:4	0%
Dec	56	56	1	110	1	110	0:4	0%
All Data	**2734**	**230**	**1**	**35000**	**50**	**2200**	**24:61**	**39%**

Figure 16. Monthly Fecal Coliform Exceedances in Oso Flaco Creek and Little Oso Flaco Creek January 2000 to September 2007.

4.4.2 Water Board TMDL monitoring

Water Board staff designed and implemented a plan for sampling and analyzing additional water column grab samples for total coliform and *E. coli*. The protocols for sample collection and analysis of pathogens are detailed in the quality assurance study plan for the project (Water Board, 2004). The objective of the additional monitoring was to evaluate relative bacterial contributions from urban and irrigated agricultural areas. The plan included wet and dry season sampling for bacteria counts. Additionally, staff wanted to determine whether genetic analysis of bacteria to determine their animal host was necessary to complete the analyses.

Staff conducted field monitoring in December 2004, and February, March, and May 2005. Staff abandoned the dry weather sampling due to the lack of flowing water and an assumption that any additional storm event data collected would not provide information to further differentiate sources. Table 5 displays a summary of data collected from various sources and locations in the Oso Flaco and Santa Maria watersheds.

Table 5. Summary of Storm Events Sites and *E. coli* Concentrations within the Oso Flaco and Santa Maria Watersheds, December 2004, and February, March, and May 2005.

Watershed/ Water body	Site(s)	Primary land use/location within drainage area	# of samples	Min. (MPN/100mL)	Log mean. (MPN/100 mL)	Max. (MPN/100 mL)
Oso Flaco / Oso Flaco Creek						
	312NMRUS; 312NMR; 312NMRDS	Rural residential runoff from Nipomo Mesa via stormwater collection system on Division Road	11	1203.3	1,997	>2419
	312BSR	Rural residential runoff and agricultural runoff in drainage/tributary to Oso Flaco Creek	6	36	444	>2419
	312OFC	Oso Flaco Creek downstream of confluence with drainage/tributary	5	157.6	298	613
Santa Maria/ Bradley Channel						
	312BCAgF1; 312BCAgF2; 312BCSD1; and 312BCSD2	Irrigated agricultural runoff from field and via surface drains	6	196.8	452	687
	312BCUUS	Receiving water within Bradley Channel Upstream of Urban inputs (City of Santa Maria); South of Jones @ Hwy 101	4	108	605	2419
	312BCUDS	Receiving water within Bradley Channel Downstream of Urban inputs (City of Santa Maria);; Western Avenue North	4	307	1,074	>2419

The log mean at all sites exceeded 126 MPN/100mL. Note that staff compared levels to receiving water criteria and water quality objectives (See US Environmental Protection Agency's bacterial indicator criteria recommendations in Section 3) for the purpose of evaluating potential sources.

Urban runoff

Urban runoff and samples taken downstream of urban areas had higher levels of *E. coli* than any other sites sampled, with all samples exceeding 126 MPN/100 mL. All samples taken from Bradley Channel downstream of the City of Santa Maria were higher than samples taken from Bradley Channel upstream of the City of Santa Maria. Additionally, there was often a wide range in the level of *E. coli* detected throughout the sampling period, with higher values found earlier in the wet season than later. For example, *E. coli* concentrations found upstream of the City of Santa Maria ranged from 2,419 MPN/100 mL in February to 108 MPN/100 mL in May 2005.

The Nipomo Mesa discharged stormwater to a stormwater collection system during storm events. This discharge flowed through drainages adjacent to irrigated agriculture, which ultimately reached Oso Flaco Creek. Samples taken of rural/urban runoff from the Nipomo Mesa always exceeded the criteria for *E. coli*, and were consistently higher than samples taken downstream in a drainage/tributary receiving both urban and agricultural runoff. Concentrations were lower than those found in the contributing drainage, with a log mean of 298.2 MPN/100 mL. Figure 17 shows *E. coli* concentrations during storm events. As mentioned previously, staff found that the Nipomo Mesa did not discharge flow during the dry season, the time of impairment. Staff concluded that the Nipomo Mesa was not contributing fecal coliform to Oso Flaco Creek based on the evidence that while discharges during the wet season from the Nipomo Mesa were elevated above water quality objectives, fecal coliform levels in Oso Flaco Creek during the wet season were within water quality objectives.

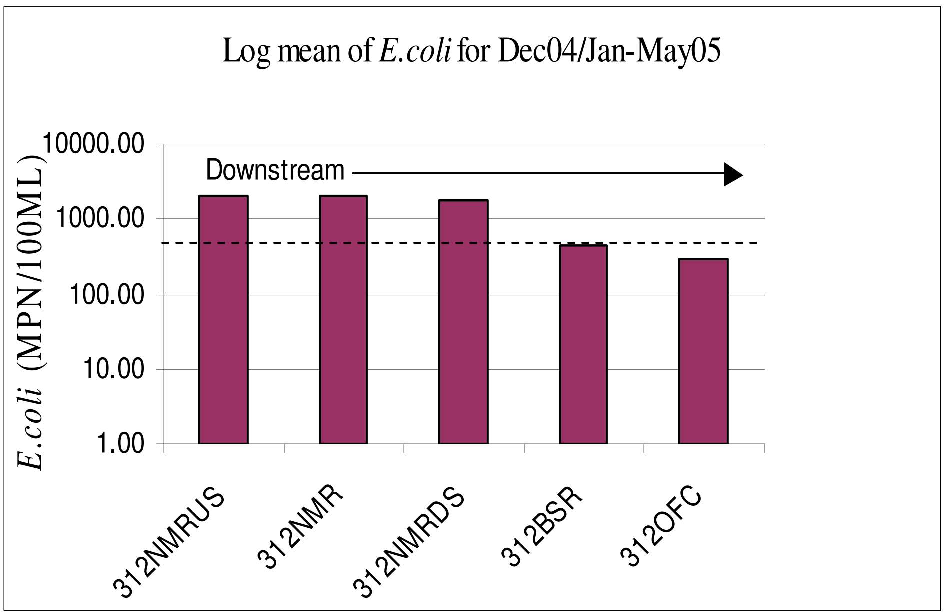


Figure 17. Log Mean of *E. coli* (MPN) During Storm Events at Monitoring Sites in the Oso Flaco Watershed December 2004 to May 2005.

<u>Agricultural runoff</u>

Sampling of irrigated agriculture runoff was limited spatially and temporally, with only two storms sampled from one type of crop operation. Samples taken from surface drains along with runoff directly from the agricultural field had a log mean of 452 MPN/100 mL (Table 5).

Flow in Bradley Channel upstream from the City of Santa Maria was almost exclusively from irrigated agriculture runoff and received some urban inputs. Concentrations of *E. coli* upstream were elevated, with four of six samples exceeding all of the *E. coli* criteria (Table 5).

Water Board staff also sampled soils in May 2005. *E. coli* concentrations in sediment collected from Bradley Channel and Oso Flaco Creek were 517 MPN/100 mL and 133 MPN/100 mL respectively.

The pathogenic O157:H7 species of *E. coli* were found in other watersheds in the Central Coast Region that have similar land uses to the Santa Maria. As a result, staff also sent eight samples from four sites to the U.S. Department of Agriculture laboratory in Albany, California for speciation for the O157:H7 *E. coli.* All samples were negative for O157:H7.

Despite the limited measurements, staff concluded the following about irrigation runoff quality in comparison to the water quality of the listed water bodies: there was no formal system to measure the rates of irrigation return flows within the watershed, and *E. coli* concentrations in runoff were elevated above criteria, but were much less than the receiving water concentrations and runoff from urban areas.

While genetic methods of microbial source tracking are considered one of the best ways available to confirm presence of specific animal sources of *E. coli*, Water Board staff concluded that conducting such a study was not realistic nor justified based on the fact that 1) existing microbial studies can be transferable to this watershed, and 2) multiple land uses with numerous sources drain to these watersheds, therefore, although microbial source analysis may identify sources, staff would have difficulty determining the land use generating each source. Furthermore, the information may not change the implementation approaches. Results from two genetic studies that can be applied to this watershed are included in the Section 5. *Source Analysis*.

4.4.3 City of Santa Maria storm event monitoring

The Water Board will be regulating stormwater through approval of Storm Water Management Plans that comply with the National Pollution Discharge Elimination System (NPDES) General Permit for discharges (Permit No. CAS000004, Order No. 2003-0005-DWQ). The municipalities in the Santa Maria and Oso Flaco watersheds must obtain approval of these plans and comply with the general permit. Some municipalities are monitoring surface and runoff quality as part of their proposed permit activities.

The City of Santa Maria began collecting data during storm events in 2004. City of Santa Maria staff chose three monitoring stations to characterize land use contributions: (1) Prell Basin, (2) Hobbs Basin, and (3) Main St, Channel North and South. Prell Basin primarily collected stormwater from agricultural areas to the west and was representative of flows which entered the City of Santa Maria. Hobbs Basin collected urban runoff and during overflows, discharged to a channel along Stowell Road and eventually flowed to the Santa Maria River. This sample site was representative of urban flows leaving the City of Santa Maria. The Main Street Channel consisted of two channels that ran on along Main Street and combined to become the Unit 2. Ditch, and discharged to the Santa Maria River.

Table 6 shows a summary of concentrations collected between 2004 and 2006. Fecal coliform levels in the North and South Channels of the Main Street Canal exceeded fecal coliform water quality objectives and were higher than those measured elsewhere. Concentrations measured in stormwater runoff from Prell and Hobbs Basins also exceeded fecal coliform water quality objectives. While the sample size of data from the City of Santa Maria limits the ability to draw strong conclusions, staff concluded that the data suggested that urban runoff was contributing to elevated fecal coliform concentrations in the Santa Maria watershed. The City plans to continue stormwater monitoring efforts indefinitely, with a minimum of three sampling events per wet season. Additional sampling will provide information to further characterize urban inputs.

Table 6. Summary of Fecal Coliform Concentrations Collected in Drainages by the City of Santa Maria.

Site / Location	No.	Min. (MPN/100mL)	Log mean. (MPN/100mL)	Max. (MPN/100mL)
Prell Basin / West of Highway One and South of Nicholson Street	5	500	1,226	2,400
Hobbs Basin / South of Stowell Road and West of A Street	4	500	2,527	17,000
Main St. Channel North and South / West Main and Hansen Lane which combine to become the Unit Two Ditch	10	900	8,666	160,000

4.4.4 Orcutt-Solomon Creek storm event monitoring

The County of Santa Barbara's Project Clean Water sponsors studies to help identify sources of pollution that lead to beach closures and to develop an understanding of how those pollutants move through the environment. Project Clean Water conducted water quality monitoring in Orcutt-Solomon Creek during nine storm events between February 2000 and February 2003. Site locations are shown in Figure 18. Site OR1 is the same as CCAMP site ORI, which was monitored on a monthly basis by CCAMP. Results are displayed in Figure 19 and Table 7.

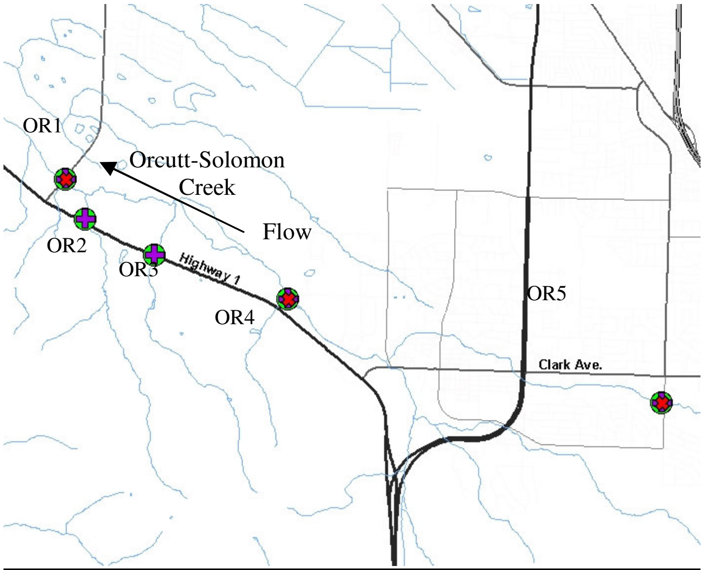


Figure 18. Project Clean Water Sampling Sites on Orcutt-Solomon Creek.

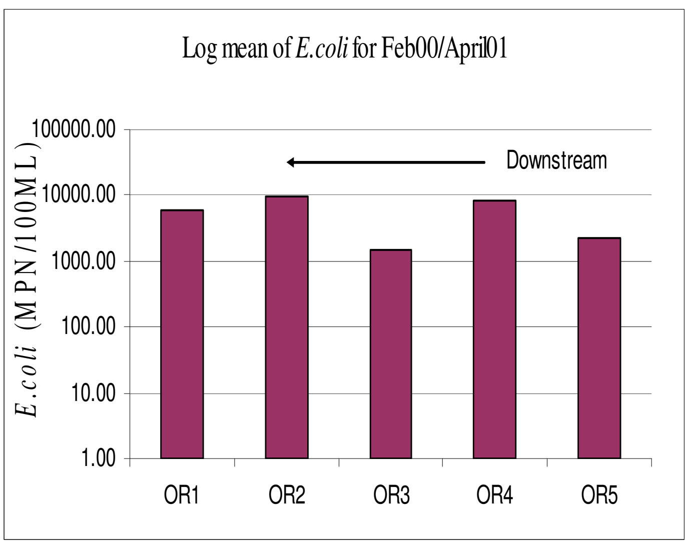


Figure 19. Log mean of *E. coli* on Orcutt-Solomon Creek.

Table 7. Summary of *E. coli* levels in Orcutt-Solomon Creek during Storm Events.

Station	Drainage area primary land uses	No.	Min. (MPN)	Log mean. (MPN)	Max. (MPN)
OR1	rangeland and irrigated agricultural	9	1,014	6,057	38,730
OR2	rangeland and irrigated agricultural	5	74	9,453	1,046,200
OR3	golf course	4	17	1,474	72,700
OR4	rangeland and urban/ rural residential	6	776	8,171	92,080
OR5	urban and commercial	9	31	2,257	155,310

Log mean of *E. coli* levels at stations OR1, OR2 and OR4 were higher than those found at stations OR3 and OR5. Station OR3 drained a golf course and Station OR5 drained urban land uses. Staff concluded that levels were likely higher at OR1, OR2 and OR4 because they drained areas with large rangeland components. All sites exceed the log mean of 126 MPN/100 mL.

4.4.5 <u>Case Study: Rangeland Management Measure Effectiveness Monitoring</u>

In a study conducted in the Morro Bay watershed (National Monitoring Program, 2003), Water Board staff collected fecal coliform data to evaluate the effectiveness of rangeland management practices. The data demonstrated that fecal coliform in the creek was reduced significantly when management practices were implemented. Staff views this as evidence that cattle access to the creek resulted in increased fecal coliform concentrations.

4.4.6 <u>Summary of Water Quality Data</u>

Several entities collected samples for fecal coliform and/or *E. coli* to confirm impairment of the listed water bodies and further identify sources. Certain sites experienced a pattern of seasonal variation, while others were elevated year-round. Specific conclusions from the water quality data discussed above, along with the information presented below are summarized in Section 4.8 *Data Analysis Summary*.

4.5 Flow Data

The Santa Maria River is characterized by lower dry-season flows than wet-season flows, and lower year-round flows than those found further upstream in the Cuyama River and Sisquoc River.

The United States Geological Survey (USGS), the County of Santa Barbara, CCAMP, and the CMP collected flow data in the project area. The USGS collected data at numerous locations in the Santa Maria River. Table 8 shows mean monthly flow data. USGS mean monthly flow values are shown in Figure 20.

Table 8. Flows (cfs) in the Santa Maria River, Cuyama River, and the Sisquoc River (1940-1999).

	time period	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
Santa Maria River at Guadalupe	**1940-1987**	60	74	137	76	3.1	0.02	0.01	0	0.09	0.03	0.71	11
Cuyama River (Below Twitchell Dam)	**1958-1983**	27	26	65	33	80	97	94	83	62	31	27	26
Sisquoc River (near Sisquoc)	**1943-1999**	83	179	151	97	35	13	5.3	2.7	2.6	2.7	6.8	27

The Santa Barbara County Water Agency (SBCWA) also collects hydrologic data for use in numerical modeling to track and address regional water conservation strategies, and water use efficiency, water supply, and sedimentation into the County's water supply and storage facilities.

CCAMP staff began collecting flow at 312SMA in February 2005. Flow was also measured by the CMP, as shown previously with CMP water quality data. These data are currently being processing for quality assurance purposes.

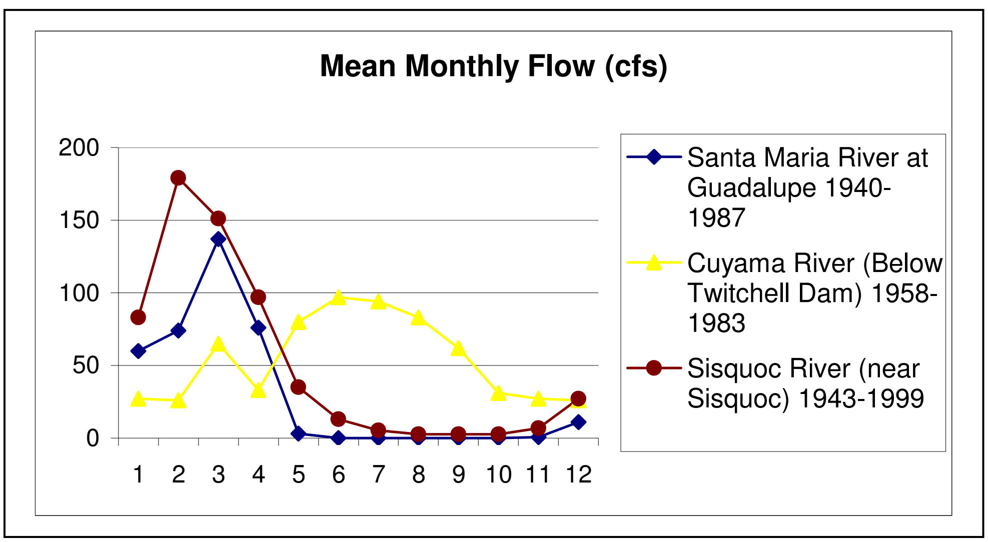


Figure 20. Flow (cfs) in the Santa Maria, Cuyama, and Sisquoc River Watersheds (USGS). Flow (cfs) and Months of the Year.

4.6 Land Use Data

Water Board staff considered spatial data for the following purposes, in preparation of this report: delineation of watershed boundaries; compilation of land use tables; preparation of orientation maps and presentation of hydrologic and transportation networks. Staff used watershed areas to describe the condition of the watershed and to interpret the relative effects of land use on bacteria levels. Staff used multiple USGS 30-meter Digital Elevation Models to determine sub-watershed boundaries for the listed water bodies. Water Board staff aggregated Multi-Resolution Land Characterization (MRLC) land use classifications into land use categories. The categories (shown in Figure 21) included the following: agricultural (irrigated), urban (including rural and commercial), and open space (including rangeland).

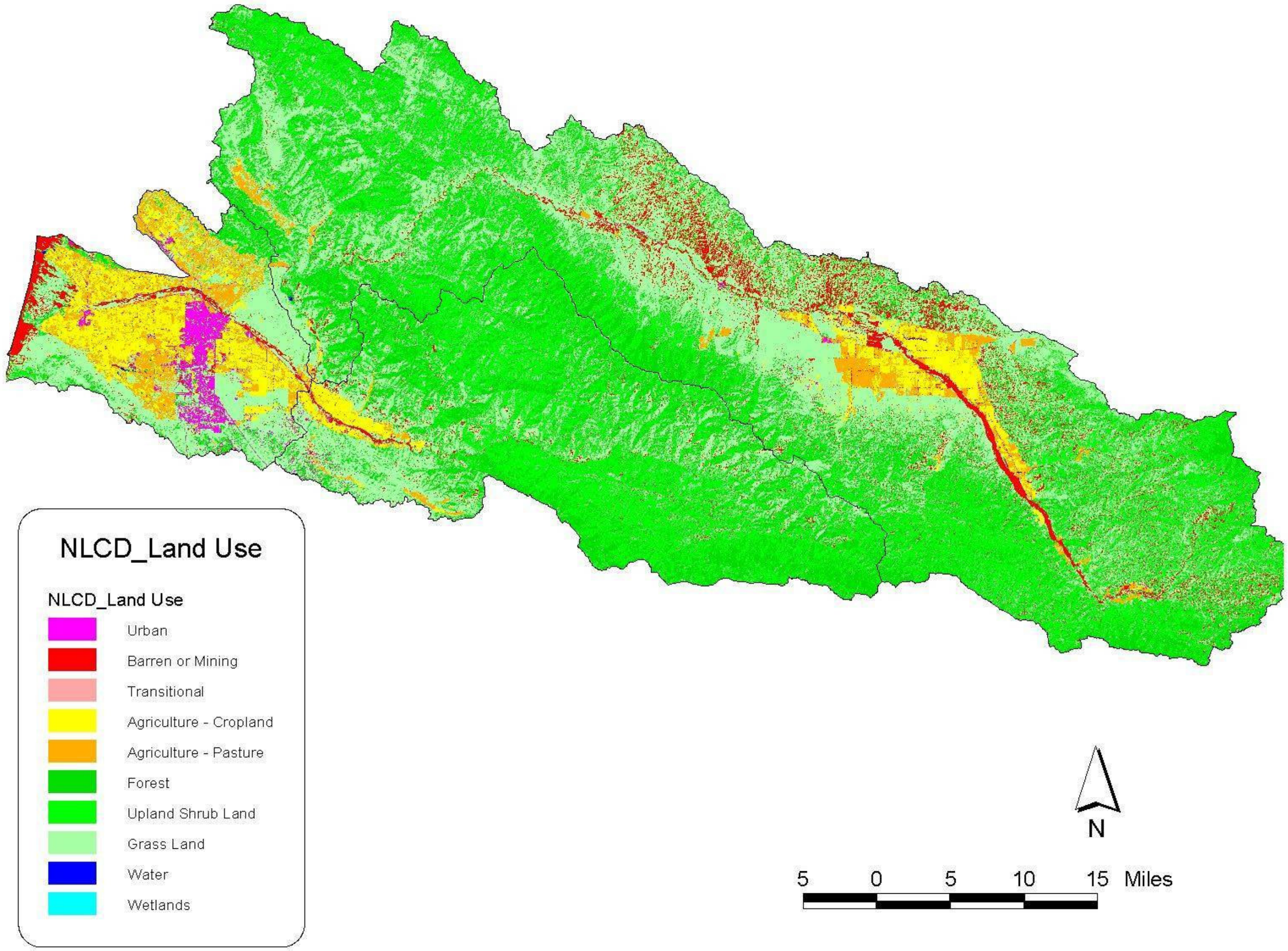


Figure 21. Land uses in the Project Area.

Table 9. Estimated Land Uses (Acres and Percent) in Subwatersheds in the Oso Flaco and Santa Maria Watersheds.

Subwatershed Land Use Areas (acres)

Land Use	Entire Project Area	Sisquoc	Cuyama	Alamo Creek	Santa Maria River	Nipomo Creek	Channels (Blosser,	Bradley Canyon	Orcutt-Solomon	Santa Maria River Mouth	Oso Flaco Creek*
Agriculture	121,324	7,825	36,042	382	19,785	9,369	3,377	4,402	20,980	4	5,980
Open Space	668,169	293,219	636,190	57,413	24,433	4,444	1,267	6,248	31,013	1,160	2,843
Urban	18,255	763	1,155	2	1,253	688	4,692	365	5,576	2	228
Total Area	807,748	301,807	673,386	57,796	45,470	14,501	9,336	11,015	57,569	1,165	9,051
% Area by Subwatershed		37.4	83.4	7.2	5.6	1.8	1.2	1.4	7.1	0.1	1.1

Subwatershed Land Use (%)

Land Use	Entire Project Area	Sisquoc	Cuyama	Alamo Creek	Santa Maria River	Nipomo Creek	Channels (Blosser,	Bradley Canyon	Orcutt-Solomon	Santa Maria River Mouth	Oso Flaco Creek*
Agriculture	15.0	2.6	5.4	0.7	43.5	64.6	36.2	40.0	36.4	0.3	66.1
Open Space	82.7	97.2	94.5	99.3	53.7	30.6	13.6	56.7	53.9	99.5	31.4
Urban	2.3	0.3	0.2	0.0	2.8	4.7	50.3	3.3	9.7	0.2	2.5
Total %	100	100	100	100	100	100	100	100	100	100	100

** includes estimated area draining Nipomo Mesa through storm-drain conveyance system.*

Table 9 displays land uses in each subwatershed, including those draining listed water bodies. Open space (including rangeland) and irrigated agriculture were the largest land uses.

Water Board staff observed that rural residential properties in the Santa Maria River watershed (e.g. Orcutt-Solomon, Bradley Canyon) contained domestic (farm) animals. Water Board staff could not draw conclusions from the GIS analysis as to the significance or the origin of the sources from rural residential land uses (e.g. manure from farm animals, failing individual septic systems). Additionally, the GIS analysis did not provide information regarding point sources. These are discussed in the *Source Analysis* Section.

4.7 Relationship of Genetic Studies to Land Use

Water Board staff evaluated results of genetic fingerprinting studies conducted in Central Coast Region watersheds to characterize sources of bacterial contamination in Santa Maria and Oso Flaco watersheds. The discussion below includes an analysis of land use influence on bacteria concentrations in two watersheds with similar land uses to Oso Flaco and Santa Maria: the Watsonville Sloughs and the Morro Bay watershed.

A study conducted in Watsonville (Water Board, 2005) determined that exceedances of bacteria water quality objectives were associated with all land uses. In an examination of the association of dominant land use with exceedances of water quality objectives, staff observed that exceedances may occur in summer and/or winter in water bodies regardless of dominant land uses. Table 10 describes land uses surrounding sampling locations and results of genetic analyses.

Staff also found a consistent depression of the bird component of bacteria with wet conditions in Watsonville. This pattern was also found in the Morro Bay watershed. Data suggested that winter runoff introduced additional pathogenic material from non-bird sources, reducing the proportion of avian, or bird bacteria from 98 to 38 percent. While this suggests contributions from terrestrial sources in the wet season, these data suggested that they may not be influenced by land use. Stated another way, terrestrial sources (dog, bovine, human) were not well correlated with a specific land use.

The data from Watsonville Sloughs also indicated that urban land uses were commonly associated with concentrations of *E. coli* in excess of water quality criteria. Furthermore, the analysis of genetic sources relative to land uses revealed that urban uses were implicated as sources of controllable fecal material from dogs and humans.

Table 10. Land Uses Surrounding Sampling Locations for Genetic Source Tracking and Results of Genetic Analysis for Wet and Dry Seasons in Watsonville Sloughs, 2003.

Land use (Percent of subwatershed)		**Humans**		**Dogs**		**Avian**		**Bovine**	
		Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Struve Slough (STR-CHE)		Percent of Sample							
Urban	45%	0	3	2	21	98	38	0	38
Commercial	45%								
Agricultural	10%								
Lower Watsonville Slough (WAT-SHE)									
Agricultural	85%	0	0	6	28	94	20	0	52
Undeveloped	15%								
Upper Harkins Slough (HAR-HAR)									
Undeveloped	65%	1	2	47	9	52	18	0	71
Grazing	20%								
Rural Residential	10%								
Agricultural	5%								

Source: Hager, et al., 2004, and SH&G, et al., 2003.

A genetic fingerprinting study was conducted in the Morro Bay watershed (California Polytechnic State University, 2002). Data collected from Chorro and Los Osos Creeks in the Morro Bay watershed indicated that bovine, or cow sources contributed the majority (31%) of *E. coli* in Chorro Creek, a watershed with 63% rangeland. Bovine sources contributed similar levels of *E. coli* during both wet and dry weather sampling. In Los Osos Creek, a watershed with a mixture of urban, rangeland, agriculture, no one source exceeded 20% of the total. Table 11 describes land uses surrounding sampling locations and results of genetic analyses in Chorro and Los Osos Creeks.

Table 11. Land Uses Surrounding Sampling Locations for Genetic Source Tracking and Results of Genetic Analysis in Chorro and Los Osos Creeks, 2002.

Land use (Percent of subwatershed)		**Avian**	**Bovine**	**Dog**	**Human**
Chorro Creek					
Urban	5.4%	11	31	6	13
Rangeland	62.8%				
Agricultural	6.1%				
Brushland	17.0%				
Woodland	8.7%				
Los Osos Creek					
Urban	16.9%	20	8	12	19
Rangeland	37.3%				
Agricultural	18.8%				
Brushland	3.3%				
Woodland	16.8%				

The land uses (rangeland, urban/commercial, rural residential, and irrigated agriculture) addressed in this project study area are similar to those in the Watsonville and Morro Bay watersheds. While it was not possible to definitively determine which sources originate from each land use because each watershed had multiple land uses, staff transferred some of the conclusions from these studies to the watersheds addressed in this report. These conclusions are summarized in the following section.

4.8 Data Analysis Summary

Staff concluded the following from the data presented above:

- The following water body segments are impaired for fecal coliform:
    - The Santa Maria River from the estuary (312SMA) to Bull Creek Road (312SBC)
    - Cuyama River: downstream of Salisbury Creek @ Branch Canyon Wash (312SAL) and upstream of the reservoir
    - All reaches of Alamo Creek
    - All reaches of Blosser Channel, Bradley Canyon Creek, Bradley Channel, Main Street Canal, Nipomo Creek, and Orcutt-Solomon Creek
    - All reaches of Oso Flaco Creek and its tributary, Little Oso Flaco Creek
- The Santa Maria River Estuary, a receiving waterbody of the Santa Maria River at monitoring site 312SMA, is impaired for fecal and total coliform.
- Fecal coliform concentrations in Alamo Creek were elevated year-round with higher levels during the wet-season; the primary managed land use was rangeland, and was likely the primary source of the impairment.
- Fecal coliform levels in the Cuyama River were elevated year-round; rangeland and rural residential land uses likely contributed to the impairment.
- The Santa Maria River was impaired by fecal coliform year-round, with concentrations higher during the dry-season; rangeland, urban, and rural residential land uses likely contributed to the impairment.
- The channels (Main, Bradley and Blosser) draining to the Santa Maria River were impaired by fecal coliform year-round; urban land uses were likely the primary land use contributing to the impairment.
- Nipomo Creek, Bradley Canyon Creek, and Orcutt-Solomon Creek were impaired by fecal coliform year-round; these watersheds had a mosaic of urban, rangeland, irrigated agriculture, and rural residential land uses.
- *E. coli* concentrations in runoff from an irrigated agriculture area were elevated, but concentrations were much lower than those found in discharges from urban areas and in receiving water.
- *E. coli* concentrations downstream of urban areas were higher than concentrations upstream, and higher than those draining agriculture.
- Discharges from the rural residential area of Nipomo Mesa and agricultural discharges are elevated, but they did not cause exceedances in Oso Flaco Creek during storm-events.
- Urban stormwater discharges from the rural residential area of Nipomo Mesa to Oso Flaco watershed did not occur during dry periods and were diluted during wet periods due to flow in Oso Flaco Creek.
- Fecal coliform levels were highest during the dry season in Oso Flaco Creek.
- *E. coli* concentrations in runoff to Orcutt-Solomon Creek from rangeland, irrigated agriculture, and rural residential land uses were higher than those draining urban/commercial and a golf course.
- Data indicate that elevated levels of bacteria are found at locations draining primarily rangeland, and that this land use can contribute significant levels of bacteria.

- Staff concluded that lack of use of sanitation facilities (e.g., portable toilets) contributed to elevated fecal coliform levels, warranting it be included as a source.
- Rural residential land uses are likely contributing to elevated fecal coliform levels, and staff concluded, that despite uncertainties regarding the significance of the sources (e.g. farm animals, individual septic systems), rural residential activities should be considered in the following source analysis.
- Staff considered rangeland, urban/commercial, and rural residential (low intensity urban) land uses as having contributed fecal coliform to the listed water bodies in this project.
- The O157:H7 species of *E. coli* was not found in a limited sample size taken within the Santa Maria watershed.
- While genetic methods of microbial source tracking are considered one of the best ways available to confirm presence of specific animal sources of *E. coli*, Water Board staff concluded a genetic study was not warranted to proceed with TMDL development and begin implementation. Transferable conclusions from previous genetic studies included the following:

    - Sources (e.g. bovine, human) can originate from watersheds draining multiple land uses and are likely originating from more than one land use.
    - While sources are not well correlated with land use data, all land uses are associated with exceedances of water quality objectives.
    - Seasonality is watershed-specific: In Watsonville, runoff during the wet season was likely due to more controllable sources, and different sources were prevalent during wet and dry periods regardless of dominant land uses. In the Morro Bay watershed, there were no significant differences in sources between wet and dry periods.
    - Watersheds with larger rangeland components contribute higher bovine sources.
    - Exceedances of water quality objectives may be solely caused from natural sources.

5 SOURCE ANALYSIS

The purpose of the Source Analysis is to identify sources and assist in allocating appropriate responsibility for actions needed to reduce these sources. Water Board staff relied on information presented in the *Data Analysis* section and considered the following:

- monitoring efforts to isolate specific causes of high bacteria loads,
- relationships between seasonal conditions and bacteria levels,
- connections between land use and bacteria concentrations,
- connections between facilities and bacterial levels, and
- uncontrollable, natural sources.

This section provides information on the potential influence of channel characteristics, land uses, permitted facilities and other entities on bacterial concentrations, and identifies the sources.

5.1 Influence of Channel Characteristics on Bacteria Concentrations

Staff evaluated several aspects of the hydrology and specific channel characteristics to determine if and how these might influence bacteria concentrations. The hydrology of the Santa Maria River and listed water bodies within the watershed, and of the Oso Flaco watershed have been significantly altered by people. Based on a Geographic Information System (GIS) analysis of digital elevations, staff observed that creek channels have been moved, watershed areas modified, and urban drainages cross watershed boundaries. Within the City of Santa Maria, staff observed that some water body segments consisted of concrete-lined channels dominated by urban runoff during rainfall events.

Additionally, staff determined that creeks in other parts of the Santa Maria watershed and in the Oso Flaco watershed lacked riparian cover that may lead to increased temperatures and a warm environment conducive to bacteriological reproduction. Furthermore, staff observed slow flowing, and stagnant water in low elevations.

Staff reviewed studies related to the influence of natural sources and conditions on bacterial levels. Research conducted by the County of Santa Cruz, Environmental Health Services, indicated that much of the bacteria that cause beach postings can come from natural sources, including algae and kelp (2004). Byappanahalli, et al (2003) found that macro-alga *Cladophora glomerata* found in streams and lakes worldwide, provided a suitable environment for indicator bacteria to persist for extended periods and to grow under natural conditions. Another study found that pulp and paper mill water systems (wood products) support the growth of numerous coliforms, especially Klebsiella Spp., Escherichia coli, Enterobacter spp., and Citrobacter spp. due to their thermotolerance. (Gauthier, et. al.).

Staff concluded that instream channel conditions (the presence of elevated temperatures, algae and other in-stream materials) may have contributed to increased bacterial levels. Staff concluded that natural, or *background* conditions may contribute to elevated fecal coliform concentrations in-stream, but the extent of the influence from these factors is unknown.

5.2 Sources of Bacteria

This section discusses the influence of activities associated with various land uses on fecal coliform. *Natural*, uncontrollable sources (e.g. wildlife; as described in Section Natural and Background Sources) can originate from each of the land uses discussed below.

5.2.1 **Domestic Animals (Cattle)**

Staff considers cattle to be a source of total and fecal coliform to the impaired waterbodies. Bacterial sources from open spaces that are grazed, in part, originate from cattle feces entering the water body.

According to the land use analysis, open space (including grazing lands, or rangeland) covered the majority (82%) of total Project Area, some of it in large contiguous areas.

Staff observed cattle grazing adjacent to and within impaired water bodies in the project area and evidence of cattle present at numerous locations, included on the Cuyama River, Alamo Creek, Santa Maria River and Estuary, and Orcutt-Solomon Creek. Staff observed strong odors, cattle waste and hoof prints on multiple CCAMP sampling events in Santa Maria River at Highway One (312SMI) and above the estuary (312SMA) as well as in Alamo Creek (312ALA) and Cuyama River at Cottonwood Creek (312CCC). At each of these sites cattle were grazing in the creek channel year-round.

Staff photo-documented cattle waste in drainages and cattle grazing in and directly adjacent to riparian areas and waterbodies during reconnaissance visits in March and September 2007. Figure 22 shows cattle grazing in the Santa Maria Estuary. Staff observed between 10-20 head of cattle in the Santa Maria River Estuary.

Figure 22. Cattle Grazing in the Santa Maria River Estuary. September 2007

Staff compared monitoring data taken in areas where cattle have access to the creek with data collected from other land uses within the project area. Levels were elevated in both lands where cattle graze and land uses without cattle access (e.g. within the urban areas of the City of Santa Maria).

Staff also evaluated the results of special studies that were designed to evaluate water quality responses to grazing activities. In the Morro Bay watershed study (National Monitoring Program, 2003), Water Board staff collected fecal coliform data to evaluate the effectiveness of cattle management practices. The data demonstrated fecal coliform in the creeks significantly changed when cattle were excluded from the creek. This data indicated that cattle were a source of fecal coliform. The type of management measures implemented (e.g. rotational grazing, cattle exclusion, off-stream water sources) can influence the rate of fecal coliform loading.

Results of genetic fingerprinting studies in other watersheds of the Central Coast Region indicated cattle as a source of fecal coliform (Section 4.7 Relationship of Genetic Studies to Land Use). Staff determined that the results of these studies could be transferred to this project as the land uses and traditional grazing management practices were similar.

Staff concluded this source contributed to exceedances of water quality objectives. Staff addresses this source in the Implementation Plan.

5.2.2 Domestic Animals (Small Animal Operations)

Small livestock operations on rural residences, such as those for horses, chickens and other farm animals may also contribute bacteria. There is evidence from other similar watersheds on the Central Coast supporting the conclusion that fecal coliform from animals such as horses and livestock that are in proximity to a waterbody, travels to the respective waterbody through stormwater runoff.

In 2006, Ecology Action, through their Livestock and Land Management Program, and the Santa Cruz Resource Conservation District, evaluated manure management in Santa Cruz, San Benito and Santa Clara counties (Ecology Action, Manure Management Survey Results, 2006). Without adequate manure management practices (e.g. storing, hauling, application practices), pathogens in manure can run into waterbodies.

Staff observed domestic animals (e.g. horses) on rural residential areas adjacent to impaired reaches that were likely discharging waste (e.g. Cuyama River, Bradley Canyon Creek, Nipomo Creek, Orcutt-Solomon Creek) during several field visits. Figure 23 shows horses grazing adjacent to the Cuyama River.

Staff concluded that fecal coliform from small animal operations contributed to exceedance of water quality objectives in the Project Area. Staff addresses this in the Implementation Plan.

Figure 23. Horses Grazing adjacent to the Cuyama River, March 2007

5.2.3 Manure (Irrigated Agriculture)

Water Board staff considered possible contributions from irrigated agricultural land use activities (including land applications and use of sanitary facilities) because it was the second largest land use, comprising 15% of the Project Area. Staff discusses the use of sanitary facilities in a subsequent section Human Waste (Lack of sanitary facility use). Staff determined that land applications of manure were not a significant enough source of fecal coliform to the watershed to be assigned an allocation.

Staff evaluated the use of applied materials on irrigated agricultural lands. Conventional agricultural operations typically use inorganic fertilizers rather than land-applied manure. Some irrigated agricultural operations may apply non-sterile manure or other incompletely composted organic materials for fertilizer or soil amendment that can contain bacteria.

Staff spoke with agricultural organizations (the Southern San Luis Obispo and Northern Santa Barbara Agricultural Watershed Coalition and the Cachuma Resource Conservation District). Staff determined the application of raw manure and use of organic compost containing animal feces was rare and that many growers used synthetic fertilizers. Furthermore, organic compost must be certified to be commercially sold. When compost is created from organic materials containing animal feces, producers use methods such as “turning under” the compost pile, restricting the size of the pile, and taking periodic temperature readings to ensure that bacteria are minimized. Additionally, irrigated agriculture owners and operators take measures to address pathogen management and prevent food borne illnesses.

At the time of writing this report, staff concluded land applications of organic materials (manure) were not occurring at a level warranting inclusion as a source of bacteria.

5.2.4 Human Waste (Lack of sanitary facility use)

Bacterial contributions can originate from human sources. This can occur on a multitude of land uses. For example, staff found that in agricultural areas field workers do not always use portable toilets provided by land owners and operators during field operations. County of San Luis Obispo and Water Board staff conducting field work observed evidence of field workers not using the portable facilities. Private citizens and County of San Luis Obispo staff photo-documented human waste in Nipomo Creek adjacent to an agricultural operation (August 19, 2007). The County of San Luis Obispo issued a Notice of Violation of Health and Safety Code Section 5411 to land owners and operators for unlawful discharge of sewage or other waste on September 5, 2007. Water Board Staff documented human waste on Green Valley, within the Orcutt-Solomon Creek watershed in 2007. Water Board Staff observed a field worker not using sanitary facilities in the Santa Maria watershed in January 2008. Additionally, private citizens observed human waste by in Oso Flaco Creek adjacent to agricultural operations and notified staff.

Existing regulations require toilet facilities be provided for food crop harvesting operations to prevent crop contamination. Local health officers, the county agricultural commissioners, and/or the State Department of Health Services are responsible for enforcement. County of San Luis Obispo, Environmental Health staff has responded to one complaint in the Project Area in over three years.

Staff concluded that human waste discharges are likely occurring on land uses other than agriculture, and are not occurring adjacent to all agricultural operations. Staff noted porta-potties located in proximity to field workers during numerous field reconnaissance events. Trucks equipped with trailers move the porta-potties as the workers move. Staff viewed this as evidence that in most cases, the portable toilets were used. Staff concluded that although there is evidence that lack of sanitary facility occurred on some agricultural lands, this activity was not associated with all agricultural lands.

Staff concluded human discharges caused exceedances of water quality objectives, particularly in Nipomo Creek, Orcutt-Solomon Creek, Santa Maria River, and Oso Flaco Creek watersheds. Staff concluded fecal coliform loading from humans was likely occurring in the project area. Human waste is addressed in the Implementation Plan.

5.2.5 Natural and Background Sources

Natural sources of pathogens include wildlife such as birds, rodents, squirrels, skunk, deer, and any other animals present in a watershed that produce fecal matter that may enter surface waters. Natural sources also include in stream reproduction of bacteria, as discussed previously in Section 5.1.

Natural sources were a source of fecal coliform on each of the land uses present in the project area, particularly in riparian areas. Staff concluded this source contributed to fecal coliform in each of the listed water bodies. Natural sources, however, are uncontrollable, and staff does not propose implementation actions to reduce loading.

Staff distinguishes “natural sources” from “controllable” wildlife sources, which are those sources attracted to or influenced by human activity, such as littering or leaving trash receptacles accessible to wildlife. Staff discusses controllable wildlife sources in Section Municipalities Subject to Storm Water Permits.

Background sources alone may or may not cause impairment of water quality.

5.3 Influence of Permitted Facilities and Entities on Bacteria Concentrations

5.3.1 Entities Subject to Discharge Permits

5.3.1.1 Sanitary Sewer Collection Systems

Several of the sanitary sewer collection systems in the Santa Maria watershed are authorized to discharge treated municipal wastewater to land. Discharge of municipal wastewater to surface water bodies is prohibited. These discharges percolate to groundwater and are filtered in the soil column. The following entities are responsible for operating the sanitary sewer collection systems, within the Santa Maria watershed:

- the City of Santa Maria,
- the City of Guadalupe,
- the Laguna County Sanitation District,
- the Nipomo Community Services District, and
- the Cuyama Community Services District.

Wastewater from collection systems can reach surface waters from sewer line overflows (spills) or leaks. Sanitary sewer overflows are overflows from sanitary sewer systems of domestic wastewater, as well as industrial and commercial wastewater, depending on the pattern of land uses in the area served by the sanitary sewer system. Sanitary sewer overflows typically contain high levels of pathogenic organisms.

Staff evaluated information provided by permitting staff at the Water Board, information provided by agency staff, and spill reports from each of the sanitary districts. Each of the sanitary districts has a Collection System Management Plan and Sewer System Management Plan.

Staff reviewed spills reported to CIWQS from 2001 to 2007 for each of the entities listed above. Two spills were reported from the City of Guadalupe and Nipomo Community Services District that did not reach a water body; no spills were reported within the Cuyama Community Services District. Staff concluded that spills within the Cuyama Community Services District, City of Guadalupe, and Nipomo Community Services District were not a source.

Spills were reported frequently within two districts: the City of Santa Maria and the Laguna County Sanitation District. Spills within the City of Santa Maria; however, were relatively small (less than 1,500 gallons) with three that discharged to a storm drain or were contained within a Santa Barbara County flood control channel. Staff could not determine from some of the spill reports if the discharge within the storm drain was carried to a surface water. However, there was potential for the spill to travel to a surface water either through stormwater or other water sources. The remainder of spills within the City of Santa Maria were contained on land.

Staff also spoke with City of Santa Maria agency staff in January 2008 regarding the condition of the collection system within the city. City of Santa Maria staff described problems within the public collection system that included, but were not limited to (1) dysfunctional lines in alleys due lack of slope necessary to move effluent, (2) collection system reaches that could not be accessed via road ways, and (3) spills from a public collection system reach discharged into River Oaks Lake, a drainage basin and park located in the Northeast section of the City of Santa Maria.

Water Board staff concluded that the City of Santa Maria has made progress in addressing issues including the use of a video camera to detect collection system problems. However, collection system integrity issues remain, and must be addressed.

Water Board staff also found reports of spills from private sewer laterals within the City of Santa Maria. However, from the data reported, staff determined that none of the private sewer lateral spills were discharged to a waterbody.

Several spills (public spills and spills from private sewer laterals) occurred within the Laguna County Sanitation District, with one large public spill exceeding 19,000 gallons in 2007. These are identified in Table 12. Despite developing an improved maintenance program in 2007, staff concluded spills within the Laguna County Sanitation District were likely a source of fecal coliform to the impaired waterbodies.

Staff also reviewed events reported to CIWQS under the statewide general order per Sanitary Sewer Overflows (SSO) search since May 2007. Spills were reported as occurring within these two districts. Spills within the Laguna County Sanitation District discharged to storm drains. To reiterate from above, there is the potential for sewage to flow or be carried to a surface water once it reaches a storm drain.

Staff concluded that the effluent discharged to land from each of the wastewater treatment plants was not contributing fecal coliform; however, spills from the Laguna County Sanitation District's Collection System and spills and leaks from the City of Santa Maria Collection System were likely contributing fecal coliform to surface waters. Staff addresses private sewer laterals in the following section, Municipalities Subject to Storm Water Permits. These are addressed in the Implementation Plan.

Table 12. Number of Spills and Range of Spill Volume within the Laguna Sanitation District.

Year	Number of Spills	Range of Spill Volume (in gallons)	Private Sewer Lateral or Public system spill?	Was a Surface Waterbody Affected?*
2007	6	1,500 – 19,000	Unclear in database; at least two were public system spills	All but one spill were discharged to a storm drain or retention basin.
2006	7	200- 12,000	Public and private	While some reports indicated a surface waterbody was not affected, others indicated spill reached a storm drain.
2005	6	200 – 1,000	Likely all public	One spill was isolated along a curb. All other spills were discharged to a storm drain.
2004	15	200 – 77,000	Public and private	One spill reached Orcutt Creek. One spill reached Orcutt Creek Basin. Six spills reached storm drains. Seven spills did not affect a waterbody.
2003	5	100 – 3,000	Public and private	Two spills discharged to land. One spill flowed to drainage inlet and two to storm drains.
2002	10	100 - 300	Public and private	Two spills were contained within channel cut for effluent irrigation piping and one of those spread to a broccoli field. One spill discharged to land. Three discharged to storm drains and three reports did not indicate the final destination of the spill.
2001	8	180 - 3743	Public and private	One to Orcutt Creek, one to Solomon Creek, three spill discharged to storm drain

* If a spill was carried to a storm drain, staff cannot determine if the spill continued to a surface waterbody or not; however, if a spill flows to a storm drain, staff determined there is potential for the spill to continue to a waterbody.

5.3.1.2 Permitted Facilities and Low Threat Discharges

The Water Board also issues Waste Discharge Requirements (WDRs) for several facilities in the Santa Maria and Oso Flaco watersheds. Several facilities (e.g. onsite systems for schools, food processing plants) are permitted for discharge to land. These facilities are authorized to discharge treated wastewater to land where fecal indicator bacteria are to be filtered from the discharge in the soil column. None of the facilities discharge to surface waters. These discharges percolate to groundwater and are filtered in the soil column. Staff discussed these facilities with Water Board permitting staff and determined they were in compliance with their permit requirements and as such, staff concluded that they were not a source of fecal coliform to impaired waters in the Project Area.

Permitted discharges to surface waters also include water supply discharges, fire hydrant testing, and vegetable cooling (ice melt), none of which are likely sources of fecal coliform bacteria in the listed water bodies. These facilities are enrolled under the General NPDES Permit for Discharges with Low Threat to Water Quality, Fruit and Vegetable Processing Waste, Order No. R3-2004-0066; and fire hydrant testing or flushing; General National Pollutant Discharge Elimination System Permit for Discharges with Low Threat to Water Quality, Order No. R3-2006-0063, NPDES No. CAG 993001. Staff discussed these facilities and their permit compliance with Water Board permitting staff and concluded that they were not a source of fecal coliform to impaired waters in the Project Area.

5.3.2 Municipalities Subject to Storm Water Permits

Storm drain discharges transfer fecal coliform to surface waterbodies. Included in this source category are private sewer laterals as it is the responsibility of the municipality to prevent waste from entering the storm drain. Lateral pipes that connect private properties to a sanitary sewer collection system (discussed previously in Section 5.3.1) can leak. Sewage can be transferred to stormdrains and surface water through private sewer laterals leaking onto a sidewalk or into a gutter. The discharge can either be carried via stormwater in the wet season, or through other water sources in the dry season.

Discharges also contain urban runoff that has the potential to contain animal waste. Pet waste enters waterways through conveyance by stormwater from the location where it is deposited, including trails frequented by people hiking with their pets (e.g. along the Santa Maria River levee), stray or feral animals, and residences adjacent to waterways.

Urban runoff may also contain bird, rodent, and other wildlife waste. Dumpster leachate can also contain animal waste. Staff considers these sources controllable to some extent. Wildlife frequent locations such as dumpsters and trash receptacles in urban and rural areas and littered areas (such as along Creeks) as feeding sites. Wildlife waste may travel to storm drains or surface waters when storms occur or when other forms of urban runoff are present, such as car washing or irrigation. Furthermore, in other watersheds, such as the Soquel Lagoon Watershed, microbial source tracking data suggests that rodents and other wildlife contribute fecal coliform to surface waters in areas of urban land use (Central Coast Regional Water Quality Control Board, 2006).

As discussed previously in Section 4.4.2 Water Board TMDL monitoring, staff conducted additional water column grab samples for total coliform and *E. coli*. A primary objective of the monitoring was to evaluate relative bacterial contributions from urban stormwater. Staff determined that urban runoff samples taken downstream of urban areas had higher levels of *E. coli* than those upstream of urban areas and any other sites sampled.

Based on comparative data upstream and downstream of urban areas, land use surrounding the Santa Maria River and other impaired waterbodies, and ribotyping studies in similar watersheds, staff concluded that fecal coliform was likely in storm drain discharges to the impaired waterbodies.

Staff concluded that stormwater is a source of fecal coliform to the listed water bodies.

5.4 Potential Influence of Onsite Sewage Disposal Systems on Bacteria Concentrations

Human sources of bacteria can originate from failing onsite sewage disposal systems (septic systems) often in rural residential areas. Onsite sewage disposal systems generally provide a safe and effective means of handling domestic sewage needs in rural areas. However, many septic systems are located near water bodies where there is evidence of elevated bacteria levels and may impact uses of the water bodies. Staff evaluated whether onsite sewage disposal systems are a source in San Luis Obispo and Santa Barbara Counties.

An important factor for an onsite sewage disposal system to function effectively is sufficient depth of unsaturated soil below the leachfield where filtering and breakdown of wastewater constituents can take place. Without adequate separation distance to the water table, groundwater becomes vulnerable to contamination with pathogenic bacteria and viruses, as well as other wastewater constituents (Cuesta Engineering Corporation, 2003).

Staff concluded that onsite sewage disposal systems failures on residences adjacent to impaired water bodies may be a source of fecal coliform to the listed waterbodies within San Luis Obispo County. Within San Luis Obispo County, Nipomo Creek and Oso Flaco watersheds comprise of some rural residences not on collection systems adjacent to impaired reaches. In the Nipomo Creek watershed, there were documented physical problems with surfacing septage and other septic system failures. For example, small lot sizes, coliform and nitrate in supply wells near leachfields, and historic incidence of typhoid resulted in a prohibition zone and requirements for individual sewage disposal systems to connect to a wastewater treatment plant.

The Nipomo Community Services District operates the wastewater treatment plant that was constructed following the discharge prohibition established for the most densely developed portions of the community. Many of the individual sewage disposal systems within the prohibition zone were connected to the sewage treatment plant. Systems within the prohibition zone that were not yet connected may be contributing fecal coliform loads due to numerous factors in the County (e.g. close in proximity to the water body, elevated groundwater without adequate separation distance to the water table, older residences/systems, higher density of homes) during or after an extremely wet storm event. At the time of writing, fifty-two properties still needed to connect to the sewage treatment plant (S. Marks, pers comm. August 13, 2007). During dry periods, sewage from failing septic systems probably did not reach surface waters unless a failure occurred very close to a creek or tributary.

Sanitary surveys have not yet been completed in San Luis Obispo County, except for a few locations not in the Project Area. Staff did not personally observe failing onsite sewage disposal systems. To determine whether or not onsite sewage disposal systems were a source, staff evaluated available information as discussed below.

Staff reviewed suitability and potential of a soil type for specific uses, including septic tank absorption fields (Soil Survey, San Luis Obispo County, California Coastal Part, 1984). In the Oso Flaco area, some onsite sewage disposal systems would not function properly due to the water table and poorly drained soils. In some places, depth to groundwater is 10-20 inches (U.S. Department of Agriculture, 1984). In the Nipomo watershed, septic tank absorption fields may not function properly due to slow permeability.

Staff spoke with three business owners of septic tank pumping services in the community. According to these business owners, most onsite sewage disposal system owners did not know how to maintain their system. While they did not note any generalized problem areas, they indicated that individual systems are problematic throughout the project area.

Staff did not find evidence of specific onsite sewage disposal systems failures, but could not demonstrate that individual failures were not occurring. As such, staff concluded that the septic system failures in the Nipomo Creek watershed, both inside and outside the prohibition zone along with those in the Oso Flaco Creek watershed, may have occurred during the time of study. Staff concluded that onsite sewage disposal systems failures on residences adjacent to impaired water bodies may be a source of fecal coliform to the listed waterbodies within San Luis Obispo County.

Staff concluded that onsite sewage disposal systems failures on residences adjacent to impaired water bodies may also be a source of fecal coliform to the listed waterbodies within Santa Barbara County. Santa Barbara County Environmental Health Services hired Questa Engineering Corporation to conduct the Septic System Sanitary Survey of Santa Barbara County (2003). This effort was a survey and compilation of previously existing information on septic systems in the county, not a scientific study to delineate the discharge of pollutants entering ground water that flows into surface water. The survey was not intended to isolate or evaluate the functioning status or impact from individual septic systems. The purpose of this survey was to collect and consolidate pertinent data regarding onsite sewage disposal systems, assess the associated impact on public health and water quality, and develop recommendations on ways to address certain types of problems or specific problem areas. The study focused on areas that encompass the heaviest concentrations of septic systems and the areas of potentially greatest concern from a public health and water quality perspective. These included several small subdivisions (including Foxenwood Estates and Lake Marie Estates) in the Orcutt-Solomon Creek subwatershed.

The areas evaluated also provided the basis for presenting the full range of conditions and problems that need to be addressed in regard to septic system usage throughout Santa Barbara County. The Sanitary Survey included a series of recommendations to address septic system problems in Santa Barbara County. Recommendations included various general management measures that can be implemented by the County Environmental Health Services to address certain types of problems or situations, as well as more specific measures applicable to the individual Focus Areas examined in the study. Researchers assessed data and evaluated information to identify and prioritize areas for further study of the onsite systems.

Using the data collected in the study, an overall problem assessment was made for each of the identified septic system Focus Areas, including impacts on both surface water quality and groundwater quality. According to the study, the soils in the Orcutt area were generally moderate to well drained; however, locally, permeability and septic system suitability could be restricted due to accumulation of finer-grained sediments or high water table conditions. Researchers assigned a "low" and "low/medium" rating to the Focus Areas that had many older systems and some localized problems due to restrictive (slowly permeable) subsoils within the Orcutt-Solomon Creek subwatershed, and concluded there was little or no existing or prior evidence of water quality impacts that would implicate septic systems. Orcutt Creek Sampling stations overlap/supplement Project Clean Water sampling near Foxenwood estates.

Despite some uncertainty as to the extent of failing onsite sewage disposal systems and impact to each of the impaired waterbodies, staff concluded that they may be a source of fecal coliform in the listed water bodies in both counties due to the absence of onsite wastewater management plans, slow permeability, depth to groundwater, as well as reports of improper maintenance practices. As such, staff recommends actions in the Implementation Plan.

5.5 Source Analysis Summary

Bacteria levels throughout the Cuyama, Santa Maria, Orcutt-Solomon, and Oso Flaco watersheds were elevated and varied by season, and contained a multitude of land uses. Despite multiple sampling efforts, the outcomes did not definitively specify relative sources of fecal coliform from each land use, but rather confirmed that fecal coliform was originating from many of the land uses. As such, staff considered numerous activities associated with multiple land uses as potential sources.

Staff considered the difficulty of isolating sources, even at small watershed scales using conventional sample analysis methods such as multiple tube fermentation. Additional sample analyses or data collection methods (e.g., genetic study) might provide more information to confirm presence of specific animal sources of *E. coli* and fecal coliform entering each of the listed water bodies. However, numerous land uses drain to each waterbody and such information would not provide information about which source category (e.g. human waste from lack of facility use, onsite sewage disposal systems, or collection system spills) was responsible for the specific source organism (e.g. human). As such, staff concluded that substantial information would not be gained from conducting such a study, and sufficient information was available to determine likely sources to the listed water bodies and implement actions to address them.

Staff concluded that the following sources and source categories were most likely to contribute to impairment of the listed water bodies based on the data presented, in decreasing order of contribution. Table 13 shows sources associated with the various land uses considered in the analysis.

Table 13. Sources of Total and Fecal Coliform to Santa Maria and Oso Flaco Watersheds.

Source Category	Source Organisms	Land Use Category
Urban (including private sewer laterals)	Dogs, cats, human.	Urban
Domestic Animals (Cattle, Livestock and Farm Animals)	Examples include: cattle, horses, pigs, goats, sheep, chickens.	Rangeland; Rural Residential
Failing Onsite Sewage Disposal Systems (Septic systems)	Human	Rural Residential
Spills and Leaks from Sewage Collection System	Human	Urban
Human waste (lack of sanitary facility use)	Human	All
Controllable wildlife (dumpsters and litter)	Examples include: Birds, rodents.	Urban
Natural	Examples include: wild pigs, skunk, opossum, birds (including fowl), and deer. Also includes instream channel characteristics resulting in increased temperatures that may promote bacteriological reproduction	All

The ability to definitively differentiate the origin of the sources from each land use type and from the uncontrollable sources is the chief uncertainty in developing the TMDLs. Furthermore, there is uncertainty regarding the amount and relative contribution of bacterial loading from sources originating from certain land uses, particularly from rural residential areas. Continued monitoring of the listed water bodies, and future discharge or runoff monitoring, will provide more information to determine whether the allocations from controllable sources are met, thereby minimizing uncertainty about the impacts of loads on water quality.

6 CRITICAL CONDITIONS AND SEASONAL VARIATION

Staff determined that there was a pattern of seasonal variation based on review of the exceedance monitoring data. While exceedances were found at all sites year-round, some sites were more variable and elevated during the dry season, some sites during the wet season, while others year-round.

The following waterbodies had higher fecal coliform levels during the dry season than the wet season:

- Santa Maria River,
- Santa Maria Estuary,
- Oso Flaco Creek, and
- Little Oso Flaco Creek.

The following waterbody had higher fecal coliform levels during the wet season than the dry season:

- Alamo Creek.

The following waterbodies had high fecal coliform levels year-round:

- Orcutt-Solomon Creek,
- Nipomo Creek,
- Bradley Channel,
- Blosser Channel,
- Main Street Canal, and
- Cuyama River.

The following waterbody had high total coliform levels year-round:

- Santa Maria Estuary.

Critical conditions for this project may include the influence of weather, flow, and temperature conditions, but the extent of the influence on bacteria conditions is uncertain.

Staff concluded that since in some cases fecal coliform levels were elevated year-round, allocations and implementation needed to be implemented year-round to resolve impairment, rather than based on seasonality. Additionally, due to the uncertainties discussed previously, staff concluded the most protective approach is to establish TMDLs, allocations and implementation per critical conditions year-round. Therefore, recommendations for this project apply during all seasons to address the most critical conditions.

7 TMDL CALCULATION AND ALLOCATIONS

A Total Maximum Daily Load (TMDL) is the loading capacity of a pollutant that a water body can accept while protecting beneficial uses. Usually, TMDLs are expressed as loads (mass of pollutant calculated from concentration multiplied by the volumetric flow rate), but in the case of total and fecal coliform, it is more logical for TMDLs to be based only on concentration. TMDLs can be expressed in terms of either mass per time, toxicity or other appropriate measure [40 CFR §130.2(I)]. Concentration-based TMDLs are logical for this situation because the public health risks associated with recreating in contaminated waters scales with organism concentration, and pathogens are not readily controlled on a mass basis. Therefore, staff proposes establishing concentration-based TMDLs for total and fecal coliform in the listed water bodies.

TMDLs are established for the following reaches in the following water bodies:

1. Santa Maria River: the Estuary to Bull Creek Road (312SBC)
2. Oso Flaco Creek and its tributary, Little Oso Flaco Creek, upstream of Oso Flaco Lake
3. Cuyama River: downstream of Salisbury Creek @ Branch Canyon Wash (312SAL) and upstream of the reservoir
4. Alamo Creek: the entire reach
5. Blosser Channel, Bradley Canyon Creek, Bradley Channel, Main Street Canal, Nipomo Creek, and Orcutt-Solomon Creek: the entire reach
6. The Santa Maria River Estuary: downstream of 312SMA

The TMDLs are the same set of concentrations as were proposed in the numeric targets section for total and fecal coliform. The TMDLs are set at a concentration equal to the water quality standard concentrations. Staff concluded that these concentrations of total and fecal coliform represent the maximum loads that can be discharged to these waterbodies and still meet water quality standards. Allocations are shown in Table 12.

The TMDLs for the listed water bodies are:

Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 per 100 mL, nor shall more than 10 percent of samples collected during any 30-day period exceed 400 per 100 mL.

In addition, the TMDLs for the Santa Maria Estuary are as follows:

At all areas where shellfish may be harvested for human consumption, the median total coliform concentration throughout the water column for any 30-day period shall not exceed 70/100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230/100 ml for a five-tube decimal dilution test or 330/100 ml when a three-tube decimal dilution test is used.

Table 14. Allocations to Responsible Parties.

Entire Project Area or Watershed (including tributaries)	Responsible Party and Source	Receiving Water Fecal Coliform (MPN/100ml)
WASTE LOAD ALLOCATIONS		
Santa Maria, Nipomo, and Orcutt-Solomon	San Luis and Santa Barbara County and City of Santa Maria (Storm Water) municipalities (including private sewer laterals)	Allocation-1
Santa Maria	City of Santa Maria / Collection System	Allocation-2
Orcutt-Solmon	Laguna County Sanitation District / Collection System	Allocation-2
LOAD ALLOCATIONS		
Entire Project Area	Operators or owners of domestic animals (cattle)	Allocation-1 Allocation-3
Entire Project Area	Operators or owners of domestic animals (small animal operations)	Allocation-1
Entire Project Area	Operators or owners of rural residential properties (w/failing onsite sewage disposal systems)	Allocation-1
Entire Project Area	Operators or owners of properties (with human waste discharges due to improper facility use)	Allocation-1
Entire Project Area	Natural and Background Sources	Allocation-1

Allocation-1 = Fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, shall not exceed a log mean of 200 MPN/100mL, nor shall more than ten percent of total samples during any 30-day period
exceed 400MPN/100 mL.
Allocation-2 = Fecal coliform concentration shall not exceed Zero mPN/100 mL.
Allocation-3 = Total coliform concentration, the median throughout the water column for any 30-day period shall not exceed 70MPN/100 ml, nor shall more than ten percent of the samples collected during any 30-day period exceed 230MPN/100 ml for a five-tube decimal dilution test or 330MPN/100 ml when a three-tube decimal dilution test is used.

Permitted discharges to surface waters such as water supply discharges, fire hydrant testing, and vegetable cooling (ice melt) were meeting allocations because these sources were discharging at levels below water quality objectives (fecal coliform numeric targets). These are enrolled under the General NPDES Permit for Discharges with Low Threat to Water Quality:

- Fire hydrant testing or flushing; Order No. R3-2006-0063, NPDES No. CAG 993001
- Fruit and Vegetable Processing Waste, Order No. R3-2004-0066

The waste load allocations to municipalities for stormwater address future growth, because measures identified in the Implementation Plan include increase of pervious surfaces to prevent an increase in runoff volume from additional area and practices for new and redevelopment to minimize and prevent the addition of new bacterial sources of stormwater runoff.

Staff assigned responsible parties discharging to upstream receiving waters allocations for fecal coliform (Allocation -1). The Santa Maria Estuary receives bacterial loading from the Santa Maria River, as well as from domestic animals (cattle) grazing in and adjacent to the estuary. At the time of writing, significant efforts were underway by landowners and partnering agencies to remove cattle access to the estuary. Staff assigned owners and operators of domestic animals (cattle) an allocation for total coliform (Allocation -3) as well as for fecal coliform. Staff assumed that if the fecal coliform TMDLs in the Santa Maria River at 312SMA are met and grazing management measures are carried out adjacent to the lower river and estuary, then total coliform TMDLs will be met downstream in the tidally influenced estuarine waters and surf zone of the Santa Maria Estuary.

The proposed waste-load and load allocations for all *non-natural* sources are equal to the TMDL concentration and focus on reducing or eliminating the controllable sources of fecal coliform. These sources shall not discharge or release a “load” of bacteria, or fecal coliform that will increase the load above the loading capacity of the water body. All areas will be held to these allocations.

The allocation to background (including natural sources from birds) is also the receiving water fecal and total coliform concentration equal to the TMDL. The parties responsible for the allocation to controllable sources are not responsible for the allocation to natural sources. This is reasonable because data showed levels were below water quality objectives where there were primarily natural sources, such as the Sisquoc River.

Should all control measures be in place and total and fecal coliform levels in the impaired reaches of the watershed and total coliform levels in the estuary remain high, investigations (e.g., genetic studies to isolate sources, additional monitoring to evaluate influences of channel characteristics) will take place to determine if the high level of total and fecal coliform is due to uncontrollable sources. Responsible parties may demonstrate that controllable sources of total fecal coliform are not contributing to exceedance of water quality objectives in receiving waters. If this is the case, staff may consider re-evaluating the targets and allocations. For example, staff may propose a site-specific objective to be approved by the Water Board. The site-specific objective would be based on evidence that natural, or “background” sources alone were the cause of exceedances of the Basin Plan water quality objective for total and fecal coliform.

The TMDLs are considered achieved when the allocations assigned to the controllable and natural sources are met, or when the numeric targets are consistently met in all water bodies.

7.1 Margin of Safety

The TMDL requires a margin of safety component that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water (CWA 303(d)(1)(C)). For this project, a margin of safety has been established implicitly through the use of protective numeric targets, which are in this case the water quality objectives for water contact recreational and shellfish harvesting beneficial uses.

The total and fecal coliform TMDLs for the water bodies in this project are the Water Board's Basin Plan objectives. The Basin Plan states that, "controllable water quality shall conform to the water quality objectives..." When other conditions cause degradation of water quality beyond the levels or limits established as water quality objectives, controllable conditions shall not cause further degradation of water quality" (Basin Plan, p. III-2). Because the allocation for controllable sources is set at the numeric targets, if achieved, these allocations will achieve the water quality objectives in the receiving water. Thus, in this TMDL there is no uncertainty that controlling the load from controlled sources will positively affect water quality by reducing the indicator organism contribution.

However, in certain locations there is a possibility that non-controllable, or, natural sources will themselves occur at levels exceeding water quality objectives. And while it is controllable water quality conditions ("actions or circumstances resulting from man's activities" (Basin Plan, p. III-2)) that must conform to water quality objectives, receiving water quality will contain discharge from both controllable and natural sources.

Reporting and monitoring will indicate whether the allocations from controllable sources are met, thereby minimizing any uncertainty about the impacts of loads on the water quality.

8 LINKAGE ANALYSIS

The goal of the linkage analysis is to establish a link between pollutant loads and water quality. This, in turn, supports that the loading capacity specified in these TMDLs will result in attaining the numeric targets. For these TMDLs, this link is established because the numeric target concentrations are the same as the TMDLs, expressed as a concentration. Sources of pathogen indicator organisms have been identified that cause the elevated concentrations of pathogen indicator organisms in the receiving water body. Therefore, reductions in pathogen indicator organism loading from these sources should cause a reduction in the pathogen indicator organism concentrations measured. The numeric targets are protective of the recreational and shellfish harvesting beneficial uses. Hence, the TMDLs define appropriate water quality.

9 PUBLIC PARTICIPATION

Staff's primary goals of stakeholder involvement in the Santa Maria and Oso Flaco watersheds were for stakeholders to learn about existing implementation efforts and available information (e.g. water quality data), to communicate TMDL project status, to coordinate additional data collection, and to gain support for the potential implementation strategies and to develop additional monitoring activities, thus improving water quality and measuring improvements.

The primary framework for stakeholder involvement to date has been email and phone correspondence, staff participation in an existing group's meetings (e.g. a farm water quality short-course) and focused meetings to request specific information (e.g. water quality data) or to answer specific questions (e.g. regarding implementation approaches).

Staff has attended and presented information at numerous meetings in the Project Area. In September 2003, Water Board Staff provided an update of TMDL initiation at a farm water quality short course. In March 2005, Water Board Staff held a meeting to request cooperation from landowners to monitoring individual discharges, and to provide an update on the TMDLs. In August 2006, Water Board staff participated in an Agricultural Coalition Workshop. In December 2006, Water Board Staff held a CEQA scoping meeting and Public Workshop to gather information and to provide an update on the TMDLs. In January 2006, Water Board staff presented information related to grazing lands and regulatory options for ranchers.

In June 2006, Water Board Staff requested review and comments from the public on a preliminary report. Staff specifically asked whether the data analyses for the TMDL components included all available data and information, supported the conclusions drawn, and questioned whether there was input and ideas on implementation strategies. Staff incorporated these comments into this report. Staff also incorporated comments on the project received in December 2006 and February 2007 as part of CEQA scoping into this report.

This report will be the supporting documentation for Basin Plan Amendment (resolution, CEQA checklist, etc…) documents. Staff will circulate it for stakeholder review as well as for scientific peer review. Staff also plans to conduct an additional CEQA scoping meeting in 2008 regarding environmental impacts of actions to protect the Santa Maria Estuary and the shellfish harvesting beneficial use.

10 PROJECT MANAGEMENT

The State's Guidance for addressing impaired waters (Process for Addressing Impaired Waters in California, June 2005) describes and allows for eight phases for TMDL development projects (Project Definition, Project Planning, Data Collection, Project Analyses, Regulatory Action Selection, Regulatory Process, Approval, and Implementation). Water Board staff held a CEQA Scoping meeting to identify environmental impacts and provide project status in December 2006. Prior to that meeting, staff distributed the Preliminary Project Report. The Preliminary Project Report was the report that completes Phase Four, Project Analyses. This project is currently in Phase Five, Regulatory Action Selection, which ends with the completion of a Final Project Report. The Final Project Report will include draft staff recommendations for all components of a TMDL and an implementation plan, as well as results of independent scientific peer review, estimated costs of implementation, environmental impacts of proposed project and alternatives. In Phase Five, Water Board staff continued to further develop the Implementation Plan, and will create the Basin Plan Amendment documents. Water Board staff will then develop Basin Plan Amendment (resolution, CEQA checklist, etc…) documents based on this report, circulate it among Water Board staff, and submit the report for scientific peer review and stakeholder review. In Phase Six, Regulatory Process, the Final Project Report will be distributed for formal public comment in preparation for hearing by the Water Board.

In December 2006, Water Board staff concluded that the most efficient and effective way to address the impairment of the Cuyama River was to incorporate it into the existing fecal coliform project. In December 2007, Staff concluded that the Santa Maria Estuary and the shellfish harvesting beneficial use should be included in the project report. Staff will conduct a CEQA scoping meeting in 2008 for these component of the project.
If further evaluation of the sources and impairment results in substantial project delays, then staff will consider addressing the water bodies separately.

In February 2008, staff delayed this project's schedule to allocate resources to other high priority TMDL projects, as well as to be able to incorporate additional CCAMP fecal and total coliform data into the project analyses. At this time staff anticipates completing this project unless projects/and or programs outside the scope of this project (region-wide efforts to develop grazing and livestock regulations) require more effort than planned or influence the efficiency, priority and/or workload of the project. The TMDLs are scheduled to be presented to the Water Board for adoption in 2009.

11 IMPLEMENTATION PLAN

11.1 Introduction

The purpose of the Implementation Plan is to describe the steps necessary to reduce total and fecal coliform loads and to achieve the TMDLs. The Implementation Plan identifies the following: 1) actions expected to reduce total and fecal coliform loading; 2) parties responsible for taking these actions; 3) regulatory mechanisms by which the Water Board will assure these actions are taken; 4) reporting and evaluation requirements that will indicate progress toward completing the actions; and 5) a timeline for initiation and completion of implementation actions and Water Board staff actions. A monitoring plan designed to measure progress toward water quality goals is included in the following section.

Implementation actions and monitoring requirements rely on existing and proposed regulatory mechanisms. The Implementation Plan incorporates requirements that currently exist pursuant to an existing regulatory mechanism (e.g. permit or prohibition). The Water Board's Executive Officer is authorized to take the proposed steps to insure implementation of appropriate actions to reduce total and fecal coliform loading according to the requirements that currently exist. Other proposed actions establish new requirements that must be approved by the Central Coast Water Board, State Water Resources Control Board and California's Office of Administrative Law. These new requirements include two prohibitions as follows:

<u>Domestic Animal Waste Discharge Prohibition:</u>

The direct or indirect discharge of waste from domestic animals (including, but not limited to: horses, cattle, goats, sheep, dogs, cats, or any other animals in the care of owners/operators of these animals) from any grazing operations, farm animal and livestock facilities including paddocks, pens, corrals, barns, sheds, yards, or other activity of whatever nature into waters of the State within the areas listed below is prohibited:

Cuyama, Santa Maria, Orcutt-Solomon, and Oso Flaco watersheds and

Santa Maria Estuary

Human Waste Discharge Prohibition:

The direct or indirect discharge of human waste from any sewage spill or leak, including sewage treatment facilities or their collection systems, private or publicly owned laterals to collection systems, onsite disposal systems, e.g. septic systems, homeless encampments, or other activity of whatever nature into the waters of the State within the areas listed below is prohibited:

- Cuyama, Santa Maria, Orcutt-Solomon, and Oso Flaco watersheds and Santa Maria Estuary

These two prohibitions are discussed in the following sections where domestic animal waste and human waste are a source. Staff will work with landowners and/or cooperating entities to develop documentation details for such a program during outreach. Formal notification will occur via a 13267 letter within six months after the last land owner is informally notified of their responsibility. These prohibitions, and the associated actions are in compliance with the *Nonpoint Source Implementation and Enforcement Policy* discussed below.

The *Nonpoint Source Implementation and Enforcement Policy*, adopted as state law in August 2004, requires the Regional Water Boards to regulate all nonpoint sources (NPS) of pollution using the administrative permitting authorities provided by the Porter-Cologne Act. Nonpoint source dischargers must comply with Waste Discharge Requirements (WDRs), waivers of WDRs, or Basin Plan Prohibitions by participating in the development and implementation of Nonpoint Source Pollution Control Implementation Programs. NPS dischargers can comply either individually or collectively as participants in third-party coalitions. (The “third-party” Programs are restricted to entities that are not actual discharges under Regional Water Board permitting and enforcement jurisdiction. These may include Non-Governmental Organizations, citizen groups, industry groups, Watershed coalitions, government agencies, or any mix of the above.) All Programs must meet the requirements of the following five key elements described in the NPS Implementation and Enforcement Policy. Each Program must be endorsed or approved by the Regional Water Board or the Executive Officer (where the Regional Water Board has delegated authority to the Executive Officer).

Key Element 1: A Nonpoint Source Pollution Control Implementation Program’s ultimate purpose must be explicitly stated and at a minimum address NPS pollution control in a manner that achieves and maintains water quality objectives.

Key Element 2: The Program shall include a description of the management practices (MPs) and other program elements dischargers expect to implement, along with an evaluation program that ensures proper implementation and verification.

Key Element 3: The Program shall include a time schedule and quantifiable milestones, should the Regional Water Board require these.

Key Element 4: The Program shall include sufficient feedback mechanisms so that the Regional Water Board, dischargers, and the public can determine if the implementation program is achieving its stated purpose(s), or whether additional or different MPs or other actions are required (See Section 12, Monitoring Program).

Key Element 5: Each Regional Water Board shall make clear, in advance, the potential consequences for failure to achieve a Program'*s* objectives, emphasizing that it is the responsibility of individual dischargers to take all necessary implementation actions to meet water quality requirements.

Water Board staff held a CEQA meeting to identify environmental impacts and provide project status in December 2006. In general, the management measures that will be implemented will not adversely impact beneficial uses. Staff included documentation of environmental impacts and alternatives.

Water Board staff recognized numerous existing efforts and regulatory mechanisms aimed at reducing bacterial loading. These included, but are not limited to the following: ranchers implementing irrigated grazing management measures, rural landowners maintaining individual sewage disposal systems and implementing management measures to control livestock wastes, owners and operators of irrigated agricultural lands providing sanitary facilities, measures to control human waste, and municipalities implementing stormwater management measures. Staff identified possible implementation actions or alternatives for all sources (e.g. stormwater, agriculture, grazing) that may be contributing to the impairment. Actions that address bacterial reductions from nonpoint sources must be consistent with the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (SWRCB, 2004).

Staff discusses regulatory actions be developed or modified as part of TMDL implementation to address total and fecal coliform loading in the following section.

11.2 Implementation Actions

The following proposed actions are necessary for the water bodies to attain total and fecal coliform water quality objectives. Actions are presented associated with the corresponding source.

11.2.1 Domestic Animals (Cattle and Small Animal Operations)

Staff concluded that cattle on grazed lands and livestock (small animal operations) on rural residential properties contributed total and fecal coliform to the impaired water bodies. Owners and operators of cattle on grazed lands and livestock (small animal operations) on rural residential properties must comply with State's *Nonpoint Source Implementation and Enforcement Policy*. Staff is proposing that landowners whose land supports cattle and/or livestock develop and implement strategies to eliminate total and fecal coliform loading from these sources.

Staff proposed a Domestic Animal Waste Discharge Prohibition to address this source. To be in compliance with the prohibition, six months after receipt of formal notification, property owners must either submit a Nonpoint Source Pollution Control Implementation

Program to the Water Board Executive Officer for approval or demonstrate that land activities do not cause waste to pass into waters of the state. The Nonpoint Source Pollution Control Implementation Program must be consistent with Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program.

11.2.2 Human Waste (Lack of sanitary facility use)

Staff concluded that lack of portable toilet facility use in some areas, particularly in the Nipomo Creek, Orcutt-Solomon, and Oso Flaco watersheds, is a source of fecal coliform.

Owners and operators of all land uses are responsible for providing facilities and ensuring their use and must comply with State's *Nonpoint Source Implementation and Enforcement Policy* (above). For example, on irrigated agricultural lands, the responsibility for enforcement is the local health agency officers (e.g. County of San Luis Obispo), the county agricultural commissioners, and/or the State Department of Health Services. The California Health and Safety code (Section 113310-113360) requires toilet facilities be provided for food crop harvesting operations to prevent crop contamination. Local health officers, the county agricultural commissioners, and/or the State Department of Health Services are responsible for enforcement. Additionally, irrigated agricultural owners and operators take extensive proactive measures to address pathogen management and prevent food borne illnesses.

Staff proposed a Human Waste Discharge Prohibition to address this source. Implementing parties in violation will be issued a 13267 letter to submit documentation of a Nonpoint Source Pollution Control Program for eliminating discharges to the Water Board Executive Officer for approval OR demonstrate land activities do not cause waste to pass into waters of the state.

11.2.3 Sanitary Sewer Collection Systems

Staff concluded that the effluent discharged to land from each of the wastewater treatment plants was not contributing fecal coliform; however, spills from the Laguna County Sanitation District's Collection System may be contributing fecal coliform to Orcutt-Solomon Creek, and spills and leaks from the City of Santa Maria Collection System may be contributing fecal coliform to waterbodies that drain to the Santa Maria River. The Laguna County Sanitation District and City of Santa Maria have Collection System Management Plans and Sewer System Management Plans.

A proactive approach that requires permit enrollees to ensure a system-wide operation, maintenance, and management plan is in place, and will reduce the number and frequency of sanitary sewer overflows within the state. Dischargers will be developing collection system management plans during renewal of their permits. To facilitate proper funding and management of sanitary sewer systems, each enrollee must develop and implement a system-specific Sewer System Management Plan. All are required to enroll under statewide general order for collection systems which requires development of management plan by August 2010. Guadalupe has specific requirements in WDR Order No. R3-2005-0015 calling for adoption of a Collection System Management Plan.

Staff will rely on the existing WDRs and associated reporting to ensure that they implement an improved maintenance program, including spill response to address the spills and discharges to Orcutt-Solomon Creek and to waterbodies that drain to the Santa Maria River.

Staff addresses leaks and spills from private sewer laterals in the following section.

11.2.4 Municipal Storm Drain Discharges

Staff concluded that stormwater discharges to storm drains contributed fecal coliform to impaired water bodies. The State Water Resources Control Board adopted a National Pollution Discharge Elimination Permits (NPDES) General Permit for stormwater discharge. The General Permit requires smaller municipal dischargers, such as the Counties of Santa Barbara and San Luis Obispo, and the City of Santa Maria (Agencies), to develop and implement a Storm Water Management Program (SWMP) that has been approved by the Water Board. The goal of the SWMP is to reduce pollutant discharge through stormwater to the maximum extent practicable. The management plans must specify what management practices the municipality will use to address certain program areas. The program areas include public education and outreach; public involvement and participation; illicit discharge detection and elimination; construction and post-construction stormwater runoff management; and good housekeeping for municipal operations.

The County of Santa Barbara and the County of San Luis Obispo recently obtained general permit coverage (NPDES Permit No. CAS000004, Order No. 2003-0005-DWQ). The City of Santa Maria has submitted draft SWMPs, but has not yet obtained permit coverage.

Several unincorporated areas of the watersheds will be covered in the County's permit areas. The County of San Luis Obispo permit will include the Nipomo Mesa and "old town" Nipomo. The County of Santa Barbara permit will include the Community of Orcutt. The City of Guadalupe drains to the Santa Maria River, but will not be covered by the first five-year term of the MS4 permit.

The General Permit requires the dischargers to develop and implement a Storm Water Management Program. Staff concluded the Agencies must identify the specific sources that contribute coliform to surface waters. The Agencies shall identify and implement appropriate management measures to address these sources. The Agencies must develop and implement enforceable means of reducing coliform loading to stormwater. For example, the SWMP should include public participation and outreach management measures, including mechanisms for reaching specific target source groups. Some preventative management measures individuals can use include:

1. Dispose of domestic animal waste;
2. Require cars to be washed only at carwashes or to be washed at locations where runoff will not run into the street;
3. Require discharges of wash water from carpet cleaning, mop buckets, floor mat washing, etc. to be discharged to the sanitary sewer;
4. Require use of trash bags designed to withstand breakage for use with restaurant trash;
5. Require spill clean up with mops or absorbent material rather that washing it into a gutter or storm drain inlet; and

6. Ensure private lateral leaks are reported and repaired.

Additional measures that the Agencies could use include:

1. Develop and implement low impact development principles (including increase of pervious surfaces) and practices for new and redevelopment to minimize and prevent the addition of new sources of stormwater runoff.
2. Install vegetative buffers;
3. Conduct periodic storm drain clean-outs and maintenance;
4. Install grease traps in storm drains;
5. Maintain a street sweeping program to help prevent fecal coliform from reaching storm drains; and
6. Ensure human waste discharges do not occur.

Some of these measures are addressed in further detail below.

Staff will encourage the agencies to include such measures in the SWMPs to be presented to the Water Board for approval based on the findings in this TMDL implementation plan. If these measures are not included in the approved SWMPs, the implementation plan for this TMDL will include requirements and a timeline for such measures to be incorporated into the SWMP and annual reporting to insure TMDL compliance.

The City of Santa Maria and the Counties of Santa Barbara and San Luis Obispo will be required to report annually on the status of implementation of measures to control bacteria in stormwater. Water Board staff will review annual reports from the Agencies and assess if management practices were implemented and measurable goals were attained. If Water Board staff determines the permittee's actions were unsatisfactory, the Water Board will initiate and complete standard enforcement protocol to require permit compliance.

Storm Water Management Plan Requirements for the Agencies: Pet Wastes

The Agencies must take actions to reduce pet waste loading. Whether or not ordinances are in place and strictly enforced, pet waste, including waste from cats, on a pet owner's private property may be at risk of entering water bodies if not disposed of properly. The Water Board suggests that the Agencies educate residents about pollution from domestic dog, cat, and other pet waste from public and private property, and that they provide bags to pick up and dispose of pet waste. The Agencies should also increase enforcement of ordinances regarding pet waste and consider providing free spay and neutering program for cats.

Storm Water Management Plan Requirements for the Agencies: Dumpster Leachate and Controllable Rodent, Bird, and Other Wildlife Waste

Water Board Staff concludes the Agencies must develop management practices that specifically address dumpsters/receptacles serving restaurants or other facilities including private homes within the Agencies' jurisdiction to eliminate discharge leachate. Additionally, the County must consider ways to eliminate other controllable sources from rodents, birds, or other wildlife. For example, the Agencies should require that dumpsters always be covered and be replaced when leaks occur. They should also require that "trash clean-up day" programs be added to their stormwater management activities. The Agencies must report on the status of this source and implementing practices in their annual report once they have an approved Storm Water Management Program.

Storm Water Management Plan Requirements for the Agencies: Private Sewer Laterals

Leaks from private sewer laterals should be addressed under the SMWP if the leak results in a discharge to a storm drain. Conditions of the General Permit for municipal storm drain systems require municipalities to adopt enforceable measures to prohibit non-storm water discharges to their storm drain systems.

The Agencies must evaluate the contributions of fecal coliform from private sewer laterals and develop appropriate measures to reduce fecal coliform loading from private sewer laterals. The Agencies should consider implementing a program to require inspection or testing and upgrade at time of property transfer. A program for targeted testing in areas near the Creek subject to contamination by chronic subsurface lateral sewage leakage could also be considered. The Agencies should also implement a two or three strikes program to require lateral replacement after two or three spills depending on the cause of the spill. If they are not corrected, the Agencies should exercise authority to correct problems with private sewer laterals and bill the property owner and/or discontinue services for water to the property. The Water Board may also issue a CWC 13267 letter to all the homeowners informally notified of their responsibility.

Storm Water Management Plan Requirements for the Agencies: Public Education

The Agencies must identify how they will educate the public, what best management practices the Agencies will use to educate the public, and goals for the public education and outreach program. The Agencies should emphasize education regarding:

- proper care and maintenance of private sewer laterals, and
- proper disposal of pet waste on private or public property to keep it from entering storm drain.

Storm Water Management Plan Requirements for the Agencies: New Development

The City of Santa Maria and the Community of Orcutt had a high growth rate growing 110% between 1970 and 2000 with projections to be an additional 40% by 2030 (Santa Barbara County, 2000). The Agencies must develop and implement low impact development principles (including increase of pervious surfaces to prevent an increase in runoff volume from additional area) and practices for new and redevelopment to minimize and prevent the addition of new sources of stormwater runoff. This may also include revising ordinances, and plans to allow for low impact development (LID) principles to be implemented. The allocations to account for future development would be the same as these measures would be applied to a larger area.

11.2.5 Onsite Sewage Disposal Systems

Water Board staff spoke with agency staff and evaluated information regarding existing efforts to regulate onsite sewage disposal systems, and determined that additional information (e.g. regarding inspections and maintenance) is needed to address potentially leaking and or failing systems. Despite some uncertainty as to the magnitude of the problem and locations of specific failing onsite sewage disposal systems, staff concluded that failing onsite sewage disposal systems could not be ruled out as a source of fecal coliform.

The Water Board regulates all discharges that affect the quality of the water of the state, including those from onsite sewage disposal systems. However, the Water Board encourages direct regulation of these waste discharges by authorized and qualified local agencies where such regulation is mutually beneficial. The responsibility to oversee construction, inspection, and maintenance of septic systems lies with the local health agencies (e.g. the County of San Luis Obispo) throughout the project area.

Revised Region-wide Basin Plan Criteria

In May 2008, Water Board staff updated the Basin Plan criteria for onsite sewage disposal systems. The revised criteria included requiring development of on-site management plans (which are currently only recommended) including sanitary surveys. The proposed action updated and revised existing Basin Plan criteria for siting, design, management and maintenance of onsite wastewater systems.

The Basin Plan previously recommended that permitting agencies prepare and implement wastewater management plans. However, only one county within the Central Coast Region has developed an approved onsite wastewater management plan since the recommendation was incorporated into the Basin Plan in 1983. The new criteria require development and implementation of onsite management plans to investigate and mitigate existing and potential future water quality issues resulting from continued use of onsite systems.

State law requires submittal of a report of waste discharge (application) and issuance of waste discharge requirements (permits) by the Water Board prior to discharging waste, such as that from an onsite wastewater system (California Water Code Sections 13260 & 13264). Water Code Section 13269 allows the Water Board to waive these regulatory provisions provided such waivers do not exceed five years, are consistent with applicable state or regional water quality control plans, and are in the public interest. Historically, the Water Board entered into a Memorandum of Understanding (MOU) with permitting agencies to implement the Basin Plan criteria and comply with state law. Until 2004, the MOUs served as waivers of Water Board permits for onsite systems. However, all such waivers expired in 2004, leaving onsite systems subject to individual permitting (a cumbersome and redundant oversight). The Water Board will consider adopting a policy for waiving individual permit requirements for onsite systems sited, designed, managed and maintained in a manner consistent with Basin Plan criteria. Application and enrollment under the waiver will be required for onsite systems in areas not covered by onsite wastewater management plans. Applicants seeking enrollment in this waiver will be required to comply with Basin Plan criteria, submit enrollment fee, and comply with the local jurisdiction’s onsite management program (once it is developed). In areas covered by onsite wastewater management plans, which also implements an authorizing MOU with the Central Coast Water Board, the waiver will authorize discharge without direct Water Board oversight. Provided conditions of the onsite management plan and MOU are met, these dischargers need not submit applications to the Central Coast Water Board, pay fees, or receive waiver enrollment notification. They would simply work directly with their local jurisdiction (County or City). The proposed onsite waiver policy will be implemented through updated MOUs to ensure consistent implementation of the Basin Plan criteria for onsite systems. Water Board staff believe that this approach

(MOUs and waivers) will be most effective in protecting water quality from onsite system impacts in a streamlined fashion (without duplicative agency oversight).

In 2007, Water Board staff drafted a MOU that designated Santa Barbara County as a local agency qualified and authorized to regulate onsite sewage treatment system siting, permitting, construction inspection, monitoring, and performance requirements. Included in the MOU is the requirement that Santa Barbara County establish a County Ordinance that complies with or exceeds statewide minimum standards, the Central Coast Basin Plan (Basin Plan), and guidelines adopted thereto governing onsite sewage treatment system siting, permitting, construction inspection, monitoring, and performance requirements within the County of Santa Barbara and is at least equal to waste discharge requirements that the Central Coast Water Board would establish. The local agency is responsible for implementing the Code.

It is the joint goal of the Central Coast Water Board and the local agency to protect water quality and public health. This MOU defines cooperative roles for the local agency and the Central Coast Water Board with respect to compliance with the purpose and intent of statewide minimum standards, the Basin Plan, and applicable local ordinances and regulations governing onsite sewage treatment systems. This MOU is intended to assist in creation of a partnership between the Central Coast Water Board and local agency to protect water quality and public health in areas where onsite sewage treatment systems are utilized. The MOUs regarding onsite sewage system management are the implementation required for compliance with the Basin Plan.

Nipomo Community Services District
The Basin Plan includes a discharge prohibition from onsite sewage disposal systems in the most densely developed portions of the community of Nipomo (Water Board Resolution 78-02).

The Basin Plan includes a discharge prohibition from individual sewage disposal systems in the most densely developed portions of the community of Nipomo (Water Board Resolution 78-02). The Nipomo Community Services District surveyed and confirmed that all residences (approximately 1000) within the prohibition zone are connected to the sewage treatment plant or are being required by the Nipomo Community Services District to connect. At the time of writing, the Community of Nipomo was developing a Wastewater Master Plan. The Nipomo Community Services District notified over 200 properties within the septic system prohibition area that were not connected to the sewage treatment plant, and is planning to prioritize un-sewered areas within the septic prohibition area and expand the wastewater treatment plant collection system. At the time of writing, 52 properties still needed to connect to the sewage treatment plant (S. Marks, pers comm. August 13, 2007). The Nipomo CSD was also planning a major upgrade to the plant to address elevated nitrate levels in groundwater.

The County of San Luis Obispo and/or the Nipomo Community Services District should ensure that 1) all individual sewage disposal systems within the prohibition zone are connected to the sewage treatment plant and 2) that all individual sewage disposal systems outside of the prohibition zone are functioning properly. The Water Board may issue a CWC 13267 letter to all the homeowners informally notified of their responsibility. The management plan will address all onsite sewage disposal systems outside of the prohibition zone to ensure they are functioning properly.

Human Waste Discharge Prohibition
While the Water Board along with the Counties of San Luis Obispo and Santa Barbara regulate individual sewage disposal systems, the ultimate responsibility for each individual sewage disposal system is the individual owners and operators. A municipality can volunteer on behalf of the owners of an onsite sewage disposal systems to develop a waste water management plan. Owners and operators of onsite sewage disposal systems on rural residential properties are responsible for their systems and must comply with State's *Nonpoint Source Implementation and Enforcement Policy* (above). The Human Waste Discharge Prohibition addresses this source.

The Water Board may issue a CWC 13267 letter to all the homeowners notifying them of their responsibility per the Human Waste Discharge Prohibition. While the individual property owners are ultimately responsible, staff proposes that Community Services Districts and/or Counties where there are septic systems in rural areas likely to be discharging fecal coliform (e.g. are older, in higher density areas, are close in proximity to a water body), 1) provide evidence that they are not discharging fecal coliform to surface water bodies or 2) develop an on-site wastewater management district to oversee inspections, and require maintenance of existing systems. The Water Board may also send a letter directing the Districts and/or Counties pursuant to CWC 13225(c) to investigate and report on any technical factors involved in water quality control or to obtain and submit analyses of water.

If the Water Board determines Santa Barbara and San Luis Obispo Counties are not making adequate progress on detecting, repairing and enforcing against discharge from onsite sewage disposal systems, landowners with onsite sewage disposal systems must submit evidence to the Central Coast Water Board demonstrating they are not discharging from their onsite sewage disposal system. The Executive Officer will request this information from landowners with onsite sewage disposal systems pursuant to section 13267 of the California Water Code.

Before requesting this information, the Central Coast Water Board will consult with Santa Barbara and San Luis Obispo Counties. If the Central Coast Water Board determines Santa Barbara and San Luis Obispo Counties are making adequate progress on detecting, repairing and enforcing against discharge from onsite sewage disposal systems, the Central Coast Water Board may not send out letters to landowners with onsite sewage disposal systems pursuant to section 13267 of the California Water Code.

11.3 Conclusions

The actions represent minimum required actions to address fecal and total coliform impairments. The Water Board or the Executive Officer may alter the tasks defined above if sufficient water quality improvements are not realized. The Water Board or the Executive Officer will make modifications to the tasks listed below pursuant to, but not limited to, the regulatory mechanisms articulated in the table. Staff outlines evaluation below, and monitoring activities in the Monitoring Plan (Section 12).

11.4 Evaluation of Implementation Progress

Water Board staff will conduct a review of implementation actions and will conduct triennial reviews of all reports and water quality information for progress towards achieving the TMDL. Water Board staff will use annual reports, NPS Pollution Control Implementation Programs, as well as other available information, to review water quality data, implementation efforts, and overall progress toward achieving the allocations and the numeric target.

Water Board staff may conclude that ongoing implementation efforts are insufficient to ultimately achieve the allocations and numeric targets. If staff makes this determination, staff will recommend that additional reporting, monitoring, or implementation efforts be required either through approval by the Executive Officer (e.g. pursuant to Section 13267 or Section 13383 of the California Water Code) or by the Water Board (e.g. through revisions of existing permits and/or a Basin Plan Amendment). Staff may conclude that at the time of review they expect implementation efforts to result in achieving the allocations/numeric target and anticipated implementation efforts should continue. Water Board reviews will continue until the TMDL is achieved.

Responsible implementing parties identified in Table 13 will monitor according to the proposed monitoring plan (see Section 12) for at least three years, at which time Water Board staff will determine the need for continuing or otherwise modifying the monitoring requirements.

If after 15 years the TMDL is not achieved and controllable sources of total and fecal coliform are not contributing to exceedance of water quality objectives in receiving waters, staff will consider modifying numeric targets and/or allocations.

11.5 Timeline and Milestones

Staff anticipates that the allocations, and therefore TMDL, will be achieved 15 years from the date of TMDL approval. The estimation is based on the cost and difficulty inherent in identifying the origins of coliform from all sources. The estimation is also based on the uncertainty of the time required for water quality improvements resulting from best management practices to be realized. Small Storm Water Management Program permits outline a 5-year schedule for full implementation of best management practices (BMPs) and activities. In general, stormwater BMPs are designed to achieve compliance with water quality standards to the maximum extent practicable through an iterative process. Staff anticipates that the full in-stream positive effect of all the management measures will be realized gradually, and as such anticipates 15 years until the TMDLs are achieved.

This schedule is inline with the Water Boards measurable goals for 80% healthy aquatic habitat and properly managed lands by 2025.

11.6 CEQA Alternatives Analysis

Water Board staff conducted a California Environmental Quality Act (CEQA) scoping meeting and public workshop in December 2006 to discuss development of TMDLs and Implementation Plans for the control of discharges of fecal coliform.

This meeting and workshop provided participants with: 1) an explanation and understanding of the TMDL projects under development, 2) an opportunity to comment on the Project, and 3) an opportunity to comment on the appropriate scope and content of the environmental analysis and environmental documentation for these projects to be prepared pursuant to the California Environmental Quality Act (CEQA) (Public Resources Code Section 21000 et seq.) and the Water Board's certified regulatory program for basin planning (California Code of Regulations, Title 14, Section 15251, subdivision (g); and Title 23, Section 3775 et seq).

Interested persons were specifically requested to provide information about:

- How they or responsible parties would foreseeably comply with the TMDL;
- The reasonably foreseeable significant environmental impacts associated with those means of compliance;
- Specific evidence supporting that such impacts are reasonably foreseeable, and describing the magnitude (how significant) of the impacts;
- Reasonable alternative means of compliance that would have less significant adverse environmental impacts;
- Reasonable mitigation measures that would minimize any unavoidable significant adverse environmental impacts associated with the means of compliance.

The Water Board is required to undergo a certified regulatory process, by identifying adverse impacts to the environment in a subsequent environmental document. To facilitate a discussion at the scoping meeting to best identify all impacts, Water Board staff identified some potential environmental impacts from various foreseeable methods of compliance (management measures). Stakeholders discussed numerous alternatives (including a no project alternative) along with the environmental impacts of each. These are discussed below.

11.6.1 Alternatives

Staff developed alternatives based on input from stakeholders. These were as follows:

1. No Action (No TMDL)
2. Delay TMDL
3. TMDL with different targets
4. Alternative waste load and load allocations:
    a. Other wasteload and load allocations (one responsible party)
    b. Relative load allocations (load-based contributions)
    c. Equal load allocations (same load assigned to each responsible party)
    d. Allocations as equal concentrations
    e. Allocations geographically (by subwatershed)
    f. Allocations based on feasibility

   g. Allocations using water quality trading
5. Proposed Project (TMDL)

Staff evaluated the environmental impacts from implementing various foreseeable methods of compliance required as part of the proposed project, along with those of the alternatives.

11.6.2 <u>Overall environmental impacts of alternatives</u>

Staff summarized environmental impacts raised by stakeholders as follows:

1. Other areas would have TMDLs and Implementation Plans prior to this Project Area

2. Conversion of land use (from agricultural to urban) because of economic pressures, and resulting secondary impacts (traffic, air quality)

11.6.3 <u>Environmental impacts from no action (no TMDL)</u>

Existing and future efforts by municipalities and owners and operators to comply with existing stormwater requirements may be sufficient to achieve the TMDL. There are currently no formal requirements; however, of rural landowners regarding domestic animal waste to achieve the TMDLs. This would result in no additional reductions from this source. The environmental impacts from implementing additional activities or various foreseeable methods of compliance are identified below for these lands.

11.6.4 <u>Environmental impacts of delaying TMDL</u>

The environmental impacts of delaying the TMDL (e.g. until after other watersheds addressed) are that water quality may be degraded further in the project area, and improvements will take longer to be realized.

11.6.5 <u>Environmental impacts from different numeric targets</u>

Staff evaluated the impacts from using other bacterial indicator targets, and determined that total and fecal coliform indicators are sufficient to show achievement of beneficial use protection.

11.6.6 <u>Environmental impacts from alternative waste and load allocations</u>

Water Board staff could require *only* urban or *only* owners and operators of domestic animals to reduce loading. This alternative; however, would not achieve the TMDLs as reductions are needed from both. Furthermore, domestic animal waste is not regulated under existing programs. Additionally, because the environmental impacts from implementing methods of compliance are insignificant, this alternative would also result in insignificant impacts.

11.6.6.1 Water Quality Trading

Staff researched water quality trading as an alternative. It is an innovative approach to achieve water quality goals more efficiently. Trading is based on the fact that sources in a watershed can face very different costs to control the same pollutant. While trading can take many different forms, the foundations of trading are that a water quality goal is established and that sources within the watershed have significantly different costs to achieve comparable levels of pollution control (http://www.epa.gov/OWOW/watershed/trading.htm).

Where watershed circumstances favor trading, it can be a powerful tool for achieving pollutant reductions faster and at lower cost. Water quality trading will not work everywhere, however. Trading works best when:

1) there is a "driver" that motivates facilities to seek pollutant reductions, usually a Total Maximum Daily Load (TMDL) or a more stringent water quality-based requirement in an NPDES permit;

2) sources within the watershed have significantly different costs to control the pollutant of concern;

3) the necessary levels of pollutant reduction are not so large that all sources in the watershed must reduce as much as possible to achieve the total reduction needed – in this case there may not be enough surplus reductions to sell or purchase; and

4) watershed stakeholders and the state regulatory agency are willing to try an innovative approach and engage in trading design and implementation issues.

Staff reviewed the above information and an MOU to implement habitat trading to determine whether this would be feasible in the Project Area. Staff evaluated the circumstances in the Oso Flaco and Santa Maria watersheds and determined that Water Quality Trading, while a promising program, would not be feasible in the watershed because the costs of implementing management measures are similar and loads from each source needing to be reduced. Staff encourages stakeholders to consider this during later implementation as it could become an effective strategy.

11.6.7 Environmental Impacts from the Proposed Project

Connection to a sewer-system, and/or construction of a future system would cause significant impacts, although these would be temporary.

The environmental impacts of various foreseeable methods of compliance from urban areas (education and outreach regarding animal waste, use of pervious surfaces, water conservation, etc…) are insignificant. The environmental impacts of various foreseeable methods of compliance from management measures for domestic animals are insignificant. The environmental impacts of various foreseeable methods of compliance for addressing human waste are insignificant. The environmental impacts of repairing leaking private sewer laterals are insignificant.

11.6.8 Cumulative Impacts

Staff evaluated cumulative impacts of proposed actions including the following:

- food safety,
- voluntary standards, and
- other existing regulations.

Staff determined that the cumulative impacts were not significant.

Staff conducted a feasibility analysis of economic factors; any additional environmental factors should be considered as implementation actions are carried out.

11.7 Economic Considerations

Overview

Porter-Cologne requires that the Central Coast Water Board take "economic considerations", into account when requiring pollution control requirements (Public Resources Code, Section 21159 (a)(3)(c)). The Central Coast Water Board must analyze what methods are available to achieve compliance and the costs of those methods."

Staff identified a variety of costs associated with implementation of these TMDLs. Costs fall into four broad categories: 1) planning or program development actions (e.g., establishing nonpoint source implementation programs, conducting assessments, etc.); 2) implementation of management practices for permanent to semi-permanent features; and 3) TMDL inspections/monitoring; and 4) reporting costs.

Anticipating costs with any accuracy is challenging for several reasons. Many of the actions, such as review and revision of policies and ordinances by a governmental agency, could incur no significant costs beyond the program budgets of those agencies. However, other actions, such as establishing nonpoint source implementation programs and establishing assessment workplans carry discrete costs. Cost estimates are further complicated by the fact that some implementation actions are necessitated by other regulatory requirements (e.g., Phase II Storm water) or are actions anticipated regardless of TMDL adoption. Therefore assigning all of these costs to TMDL implementation would be inaccurate.

Cost Estimates

<u>Sanitary Sewer Collection System Spills and Leaks</u>

Implementation: All sanitary sewer activities including spill response, specified in the Basin Plan amendment are currently required under the existing Water Board permits and requirements. Water Board staff estimate no significant costs beyond the local agency program budget.

Inspections/Monitoring: These costs are currently required by Central Coast Water Board permits.

Reporting: These costs are currently required by Central Coast Water Board permits.

Storm Drain Discharges

The State Water Resources Control Board adopted an NPDES General Permit for stormwater discharge. The General Permit requires smaller State municipal dischargers, such as the City of Santa Maria and the County of San Luis Obispo and Santa Barbara, to develop and implement a Storm Water Management Program (SWMP). As of the date of writing this report, the Counties have approved SWMP, and the City of Santa Maria has submitted a draft in preparation of the Water Board's approval in late 2008. The Water Board has not approved Storm Water Management Program for the City of Santa Maria.

Planning or Program Development Actions: Water Board staff estimate no significant costs beyond the local agency program budget.

Stormwater Plan Implementation: To implement the requirements of the TMDL, the Central Coast Water Board may ask local agencies to develop additional management measures for pathogen reduction; identify measurable goals and time schedules for implementation; develop a monitoring program; and assign responsibility for each task. The specifics of the stormwater program efforts will not be known until Central Coast Water Board adoption of the SWMP occurs. Costs of implementing actions to comply with these efforts will be developed in upcoming months prior to Board Approval.

The University of South California conducted a survey of NPDES Phase I Stormwater Costs in 2005 (Center for Sustainable Cities, University of Southern California, 2005). They determined the annual cost per California household ranged from $18 to $46. However, these costs were just to keep the existing plan running and did not include start-up costs which may increase the total cost per household. According to Central Coast Water Board Stormwater Unit staff, recently approved Phase II SWMPs in Region 3 ranged from $21 to $130 per household. Stormwater Unit staff reported that the wide range of costs in both cases was based on many factors including the amount of revenue generated by the municipality, the size of the area covered by the SWMP, and because some municipalities did not include the cost of programs such as street sweeping that are already accounted for in other program budgets, while other municipalities did include this cost.

The agencies mentioned above are required to develop and implement a stormwater program for this Watershed independently of the Basin Plan amendment. Since this is an existing requirement under Phase II of the storm water program, no additional cost is estimated for implementing the existing storm water management program.

Inspections/Monitoring: Water Board staff is proposing the above Agencies monitor storm drains. The purpose of the monitoring is to determine the effectiveness of management measures. (The Water Board will not impose targets/allocations as effluent limits on an Agency.)

Water Board staff estimated monitoring will cost local agencies approximately $1,500 per year ($60/sample x 5 samples/sampling event x 5 sampling events per year).

Reporting: The City of Santa Maria and the Counties of San Luis Obispo and Santa Barbara are required to report independent of the TMDL under Phase II of the municipal storm water program. Therefore, no costs have been estimated for reporting.

Storm Drain Discharges-Private Lateral Upgrade Required by Central Coast Water Board Adopted SWMP

As of the date of writing this TMDL project report, SWMPs did not include a program to prevent leaking private sewer laterals from contributing to pathogen loading to urban runoff. Therefore, inspecting private sewer laterals and repairing private sewer lateral leaks is a new cost.

Inspections/Monitoring: According to the Proposition 13 Report, the cost to test for leaking private lateral is approximately $1,000

Private Lateral Upgrade Implementation: This TMDL project report requires the City of Santa Maria and the County of San Luis Obispo and Santa Barbara to develop measures to prevent leaking private sewer laterals from impacting urban runoff and stormwater flows. According to the Proposition 13 Report, the cost to repair a leaking private lateral is estimated to be $5,000.

Reporting: The County of San Luis Obispo and Santa Barbara are required to report independent of the TMDL under Phase II of the municipal storm water program. Therefore, no costs have been estimated for reporting.

<u>Onsite Wastewater System Discharges:</u>

Onsite Wastewater Disposal System Plan Implementation: As of the date of writing this report, staff recommended a new basin plan criteria as well as a Human Waste Discharger Prohibition be developed. The costs of implementing actions to comply with these efforts will be developed in upcoming months prior to Board Approval.

Inspections/Monitoring: The costs of implementing actions to comply with these efforts will be developed in upcoming months prior to Board Approval.

Reporting: The costs of implementing actions to comply with these efforts will be developed in upcoming months prior to Board Approval.

<u>Domestic Animals</u>

Planning or Program Development Actions: The cost to develop pathogen control measures at these facilities will vary from site to site depending upon constraints present at each site. Water Board staff estimate approximately eight hours is necessary for planning control actions.

Farm Animals/Livestock Plan Implementation: There are a variety of methods owners of farm animals/livestock can use to help control wastes. Some methods include installing livestock exclusion barriers, stables for horses, corrals, and manure bunkers at locations that prevent runoff from entering surface waters.

1. Livestock Exclusion Barriers: According to USEPA, the cost of permanently excluding livestock from areas where animal waste can impact surface waters ranges from \$2,474/mi to \$4,015/mi (*Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. 840-B-92-002,* United States Environmental Protection Agency, January 1993).

2. Horse Stables: Horses can be boarded at stables. According to the American Miniature Horse Association, miniature horses can be board in a professional stable for \$50 to \$150 per month per horse and full size horses can be boarded for \$200 to \$550 per month per horse. The cost depends on the facilities, pasture, and riding opportunities (http://www.amha.com/MarketTools/Profitibility.html).

3. Corral Cost: According to a Progressive Farmer website, a corral (excluding the head gate) can cost less than \$7,000. Gates cost the most-between \$3,000 and \$4,000 (http://www.progressivefarmer.com/farmer/animals/article/0,24672,1113452,00.html).

4. Manure Bunker Costs: Ecology Action has worked with landowners to install manure bunkers. Manure bunkers help prevent stormwaters from infiltrating the manure thereby causing runoff of pollutants from the manure. According to Ecology Action, the average cost for constructing a manure bunker on properties in the San Lorenzo watershed was approximately \$4000. (Each bunker was constructed on an existing cement slab, or a new one was poured and employed some type of cover - either a permanent roof or a tarp.) The cost of bunker construction varies greatly depending on the size and materials choice. When looking at bunkers for the entire program, costs ranged from \$3000 to \$15,000 (Reference: E-mail dated 5-1-2007 from Jennifer Harrison of Ecology Action).

Inspections/Monitoring: The landowner cost for inspections/monitoring will vary depending upon the elements of the Nonpoint Source Implementation Program. The cost could be low if daily property walks occur to assess and repair discharges. Costs are higher if a landowner performs water quality monitoring.

Reporting: Water Board staff estimate it would take approximately eight hours of land owner time to prepare a report to the Water Board. This report is required every three years.

Human Waste

Planning or Program Development Actions: The approaches used to control human waste can range from a land owner 1) providing sanitary facilities and ensuring their use 2) participating with local agencies to develop a comprehensive Watershed-wide solution. Water Board staff estimate the planning cost for an approach such as installing barriers may require approximately eight hours of land owner time. Landowners may devote more time to comprehensive Watershed-wide approaches.

Increase Use of Sanitary Facilities Implementation: The Water Board will identify possible properties with human waste discharges. The methods used to control these wastes will be developed by landowners as part of their Nonpoint Source Management Plan. However, a few possibilities include additional facilities and education of operators. The costs of implementing actions to comply with these efforts will be developed in upcoming months prior to Board Approval.

Inspections/Monitoring: Land owners could utilize various approaches to inspect lands for human waste. Again, the approach is dependant upon whether the land owner uses an approach in which the land owner is responsible for inspecting the property or local agencies are able to provide inspection services. The cost for additional facilities and the time it takes to educate operators, is one means to estimate this cost.

Reporting: The Water Board will identify possible properties with human waste discharges. All land owners are required to submit triennial reports to the Water Board. All land owners shall submit a report documenting that measures are in place and effectively minimizing discharges or demonstrating that no discharge is occurring from human activities. Water Board staff estimate this report will require approximately eight hours of land owner time.

Cost Summary

These costs are reasonable relative to the water quality benefits to be derived from the adopting these TMDLs.

The total cost of implementing actions to comply with these efforts will be developed in upcoming months prior to Board Approval.

12 MONITORING PLAN

12.1 Introduction

The Monitoring Plan outlines the monitoring sites, frequency of monitoring, and parties responsible for monitoring. This Monitoring Plan recommends sites and frequency, etc and requires parties to propose monitoring acceptable to the Executive Officer of the Water Board based on the recommendations. The monitoring for TMDL compliance and evaluation is the minimum staff concluded is necessary. These locations will be used to determine if the TMDL and allocations are met. If a change in these requirements is warranted after the TMDL is approved, the Executive Officer and/or the Water Board will require such changes. Although Water Board staff does not require daily samples to be collected, the samples required shall be sufficient to represent a daily load.

12.2 Monitoring Sites, Frequency, and Responsible Parties

Water Board staff recommends monthly fecal coliform monitoring in receiving waters at the following locations:

1. Oso Flaco Creek (312OFC, 312OFN, 312BSR);
2. Cuyama River (312CCC, 312CUY);
3. Alamo Creek (312ALA);
4. Nipomo Creek (312NIT; NIP);
5. Bradley Canyon Creek (312BCF);
6. Santa Maria River (312SMA; 312SMI); and
7. Orcutt-Solomon Creek (312 ORC, 312ORI, 312ORB).

Water Board staff recommends monthly total and fecal coliform monitoring in receiving waters at the following location:

1. Santa Maria River Estuary (312SME).

The above monitoring may be done in concert with the Water Board's CCAMP existing five-year rotational monitoring in the project area. Landowners and operators of activities discharging fecal coliform may participate individually or cooperatively to conduct monthly monitoring.

In addition to the receiving water locations, staff also proposes fecal coliform monitoring in stormwater runoff from the City of Santa Maria at the following locations:

1. Bradley Channel
2. Blosser Channel
3. Main Street Canal
4. Three existing stormwater monitoring sites, based on City of Santa Maria's existing monitoring and recommendations to characterize urban runoff.

Samples should be taken during three storm events and during two dry season flows (when present).

If Water Board staff determine that further monitoring efforts are necessary to determine relative contribution of specific animal sources of *E. coli* (e.g. genetic source tracking of discharges, additional receiving water stations), then Water Board staff will contact landowners, implementing parties, and/or cooperating entities. Additionally, if the executive officer determines additional monitoring is needed, he shall request it pursuant to Section 13267 of the California Water Code.

12.3 Reporting

The parties responsible for implementation and monitoring may incorporate the results of monitoring efforts in reports filed pursuant to the WDR, Small MS4 Storm water Permit, NPDES Permit, or other correspondence as requested by the Water Board pursuant to California Water Code Section 13267.

If reporting changes become necessary based on staff's assessment of the TMDL implementation progress, the Executive Officer or the Water Board will require such changes. At a minimum, the Water Board will evaluate monitoring reporting data and implementation reporting information every three years.

13 REFERENCES

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APPENDIX A CENTRAL COAST AMBIENT MONITORING PROGRAM DATA

SiteTag	Date / Time	TCOLI	FCOLI
312BCU	1/11/2000 14:00	50000	500
312NIP	1/11/2000 14:30	28000	3000
312NIP	1/11/2000 14:40	28000	300
312ORB	1/12/2000 12:00	160001	90000
312OLA	1/12/2000 12:15	5000	900
312MSD	1/12/2000 12:30	5000	1600
312ORI	1/12/2000 12:45	1600	50
312ORC	1/12/2000 13:00	1600	1600
312SMA	1/12/2000 13:15	16000	900
312SMI	1/12/2000 13:45	900	50
312OFL	1/12/2000 14:05	1600	26
312OFC	1/12/2000 14:15	3000	900
312ALA	2/1/2000 14:30	240	80
312NIP	2/1/2000 14:50	9000	3000
312ORB	2/3/2000 12:00	3000	1300
312OLA	2/3/2000 12:15	35000	17000
312ORI	2/3/2000 13:15	270	40
312ORC	2/3/2000 13:35	500	170
312SMA	2/3/2000 13:45	800	270
312SMI	2/3/2000 14:30	2400	2400
312OFC	2/3/2000 14:50	13000	1
312OFL	2/3/2000 15:00	2400	40
312OFN	2/3/2000 15:30	900	11
312MSD	2/3/2000 15:45	50000	800
312ALA	2/15/2000 13:30	1200	23
312NIP	2/15/2000 14:00	28000	5000
312BCU	2/15/2000 14:15	1700	30
312ORB	2/17/2000 12:30	130000	5000
312OLA	2/17/2000 12:45	90000	400
312ORI	2/17/2000 13:15	4000	20
312ORC	2/17/2000 13:30	16001	400
312SMA	2/17/2000 13:50	160000	400
312SMI	2/17/2000 14:15	24000	1300
312OFC	2/17/2000 14:35	160000	200
312OFL	2/17/2000 14:50	5000	20
312OFN	2/17/2000 15:00	14000	20
312MSD	2/17/2000 15:30	700000	20000
312ALA	2/29/2000 14:30	8000	
312NIP	2/29/2000 15:00	80000	
312BCU	2/29/2000 15:30	2400	
312BCF	3/2/2000 10:25	240000	
312ORB	3/2/2000 13:50	50000	
312OLA	3/2/2000 14:05	24000	
312MSD	3/2/2000 14:14	160000	
312MSD	3/2/2000 14:14	160000	

312ORI	3/2/2000 14:50	50000	
312ORC	3/2/2000 15:05	90000	
312SMA	3/2/2000 15:20	30000	
312SMI	3/2/2000 15:45	22000	
312OFL	3/2/2000 16:05	7000	
312OFC	3/2/2000 16:25	11000	
312OFN	3/2/2000 16:45	800	
312NIP	4/10/2000 15:30	28000	2600
312NIT	4/10/2000 15:50	1100	10
312OFC	4/10/2000 16:10	199	10
312OFL	4/10/2000 16:20	3000	200
312OFN	4/10/2000 16:30	16000	40
312OFN	4/10/2000 16:45	3000	200
312BCU	4/12/2000 10:16	90000	400
312BCF	4/12/2000 10:35	50000	1100
312ORB	4/12/2000 14:29	2200	1100
312OLA	4/12/2000 14:44	3000	2400
312ORI	4/12/2000 15:15	24000	500
312ORC	4/12/2000 15:58	9000	1300
312SMA	4/12/2000 16:23	16000	220
312SMI	4/12/2000 16:45	90000	3000
312MSD	4/12/2000 17:08	160001	400
312ALA	4/13/2000 12:12	500	500
312ALA	5/1/2000 11:30	500	110
312NIP	5/1/2000 11:51	9000	170
312NIT	5/1/2000 12:11	5000	800
312OFC	5/1/2000 12:31	17000	2200
312OFL	5/1/2000 12:47	1100	110
312OFN	5/1/2000 13:05	17000	2200
312BCU	5/3/2000 8:41	90000	3000
312BCF	5/3/2000 9:16	3500	260
312ORB	5/3/2000 13:58	22000	1100
312OLA	5/3/2000 14:08	50000	1700
312OLA	5/3/2000 14:14	50000	1100
312ORI	5/3/2000 14:25	14000	800
312ORC	5/3/2000 14:45	16000	1100
312SMA	5/3/2000 15:05	17000	1700
312SMI	5/3/2000 15:30	160000	2600
312BCD	5/3/2000 16:10	500	14
312ALA	6/6/2000 13:06	500	300
312NIP	6/6/2000 13:29	16000	5000
312NIT	6/6/2000 13:48	22000	9000
312OFN	6/6/2000 14:50	30000	24000
312OFN	6/6/2000 15:15	16000	9000
312OFC	6/6/2000 15:24	190000	35000
312OFL	6/6/2000 15:58	500	170
312BCD	6/7/2000 8:08	24000	3000
312BCU	6/7/2000 8:26	30000	3000
312BCF	6/7/2000 8:51	160001	90000

312MSD	6/7/2000 14:25	160001	2300
312OLA	6/7/2000 14:40	30000	3000
312OLA	6/7/2000 14:55	28000	5000
312ORB	6/7/2000 15:00	13000	3400
312ORI	6/7/2000 15:10	90000	600
312ORC	6/7/2000 15:20	160001	17000
312SMA	6/7/2000 15:45	160001	2800
312SMI	6/7/2000 16:20	160000	8000
312BCD	6/26/2000 13:30	3000	3000
312MSD	6/26/2000 13:35	50000	200
312ORB	6/26/2000 14:30	24000	3000
312ORI	6/26/2000 14:55	160001	400
312ORC	6/26/2000 15:10	50000	400
312SMA	6/26/2000 15:30	24000	1700
312SMI	6/26/2000 16:00	11000	2100
312OFN	6/26/2000 16:15	50000	200
312OFN	6/26/2000 16:20	14000	20
312OFC	6/26/2000 16:25	160000	3000
312OFL	6/26/2000 16:45	1400	200
312ALA	6/29/2000 11:30	1700	800
312NIP	6/29/2000 11:50	5000	5000
312BCU	6/29/2000 12:05	5000	260
312BCF	6/29/2000 12:45	160001	1700
312NIT	6/29/2000 15:50	7000	5000
312ALA	8/1/2000 11:40	1700	40
312BCU	8/1/2000 12:35	160001	13000
312BCD	8/1/2000 12:50	160000	30000
312MSD	8/1/2000 13:00	160001	28000
312MSD	8/1/2000 13:15	160001	28000
312NIP	8/1/2000 13:25	900	300
312NIT	8/1/2000 13:40	3000	2400
312ORB	8/2/2000 12:20	11000	3000
312ORI	8/2/2000 12:35	35000	11000
312ORC	8/2/2000 12:50	5000	2300
312SMA	8/2/2000 13:05	160001	3000
312SMI	8/2/2000 13:30	3000	2300
312OFN	8/2/2000 13:35	1700	80
312OFN	8/2/2000 13:40	240	130
312OFC	8/2/2000 13:50	160001	11000
312OFL	8/2/2000 14:10	492	130
312BCD	9/6/2000 8:15	2800	300
312BCU	9/6/2000 8:45	16000	110
312BCF	9/6/2000 9:25	160001	160001
312ORI	9/6/2000 12:35	28000	800
312ORC	9/6/2000 12:57	90000	3000
312SMA	9/6/2000 13:35	30000	3000
312SMI	9/6/2000 15:00	11000	2300
312MSD	9/6/2000 15:20	90000	2300
312ALA	9/7/2000 9:10	564	503

312NIP	9/7/2000 13:05	790	710
312NIP	9/7/2000 13:05	790	710
312NIT	9/7/2000 13:35	11000	5000
312NIT	9/7/2000 13:35	11000	5000
312OFN	9/7/2000 14:00	24000	4000
312OFN	9/7/2000 14:05	30000	4500
312OFN	9/7/2000 14:05	30000	4500
312OFC	9/7/2000 14:10	160001	810
312OFL	9/7/2000 14:40	2800	350
312BCD	10/5/2000 8:55	50000	13000
312BCU	10/5/2000 9:20	14000	1400
312ALA	10/5/2000 13:15	19000	1300
312NIP	10/6/2000 10:00	22000	5000
312NIT	10/6/2000 10:30	3000	1300
312OFN	10/6/2000 10:45	50000	11000
312OFN	10/6/2000 11:00	127000	1100
312OFC	10/6/2000 11:15	24000	230
312OFL	10/6/2000 11:55	2200	700
312SMI	10/6/2000 12:20	50000	800
312ORC	10/6/2000 13:10	22000	1700
312SMA	10/6/2000 13:40	90000	24000
312ORI	10/6/2000 14:25	78700	350
312MSD	10/6/2000 14:40	30000	24000
312ALA	11/6/2000 12:15	2300	2300
312NIP	11/6/2000 12:45	3000	2300
312OFN	11/6/2000 14:15	24000	300
312OFN	11/6/2000 14:30	24000	300
312OFC	11/6/2000 14:45	30000	200
312OFL	11/6/2000 15:00	2200	1300
312BCD	11/8/2000 9:30	5000	300
312BCU	11/8/2000 9:55	22000	1700
312BCF	11/8/2000 10:20	17000	2300
312ORB	11/8/2000 13:10	30000	11000
312ORI	11/8/2000 13:30	8000	300
312ORC	11/8/2000 13:45	24000	300
312SMA	11/8/2000 14:00	24000	230
312SMI	11/8/2000 14:30	5000	1700
312MSD	11/8/2000 15:00	14000	200
312MSD	11/8/2000 15:15	90000	300
312ALA	12/4/2000 12:20	3000	500
312NIP	12/4/2000 12:40	3000	140
312NIT	12/4/2000 13:00	3000	800
312OFN	12/4/2000 13:15	50000	1
312OFN	12/4/2000 13:30	17000	1
312OFC	12/4/2000 13:45	1600	110
312OFL	12/4/2000 14:15	1700	300
312BCD	12/7/2000 10:00	9000	220
312BCU	12/7/2000 10:15	28000	1400
312BCF	12/7/2000 10:40	2700	110

312MSD	12/7/2000 13:45	30000	800
312MSD	12/7/2000 14:15	30000	10
312ORB	12/7/2000 14:35	22000	400
312ORI	12/7/2000 14:50	9000	170
312ORC	12/7/2000 15:05	50000	2300
312SMA	12/7/2000 15:25	30000	200
312SMI	12/7/2000 15:45	14000	400
312ALA	1/3/2001 12:50	5000	5000
312NIP	1/3/2001 13:15	2400	700
312OFN	1/3/2001 13:45	3000	1
312OFN	1/3/2001 13:50	1400	1
312OFC	1/3/2001 14:15	24000	40
312OFL	1/3/2001 14:45	300	50
312BCD	1/4/2001 8:40	24000	240
312BCU	1/4/2001 9:00	30000	240
312ORB	1/4/2001 12:50	2400	300
312MSD	1/4/2001 13:15	24000	50
312MSD	1/4/2001 13:25	24000	23
312ORI	1/4/2001 13:40	90000	23
312ORC	1/4/2001 14:00	90000	40
312SMA	1/4/2001 14:34	50000	1
312SMI	1/4/2001 15:05	160000	1
312BCD	1/29/2001 8:45	90000	800
312BCU	1/29/2001 9:30	90000	400
312ORB	1/29/2001 13:35	30000	300
312OLA	1/29/2001 13:49	30000	400
312MSD	1/29/2001 14:00	160000	200
312MSD	1/29/2001 14:15	90000	400
312ORI	1/29/2001 14:30	90000	230
312ORC	1/29/2001 14:37	50000	230
312SMA	1/29/2001 15:00	16000	40
312SMI	1/29/2001 15:35	90000	400
312ALA	1/31/2001 12:59	3000	2400
312NIP	1/31/2001 13:20	5000	130
312NIT	1/31/2001 13:36	8000	1300
312OFN	1/31/2001 14:00	40000	23
312OFN	1/31/2001 14:15	9000	50
312OFC	1/31/2001 14:25	24000	80
312OFL	1/31/2001 15:24	2300	40
312BCD	2/28/2001 9:10	90000	700
312BCU	2/28/2001 9:30	160000	230
312OLA	2/28/2001 13:45	9000	500
312ORB	2/28/2001 13:55	13000	800
312ORI	2/28/2001 14:15	16000	300
312ORC	2/28/2001 14:30	50000	800
312SMA	2/28/2001 14:55	13000	230
312SMI	2/28/2001 15:22	8000	80
312ALA	3/1/2001 12:39	3000	70
312NIP	3/1/2001 12:59	8000	300

312NIT	3/1/2001 13:44	5000	40
312OFN	3/1/2001 14:19	3000	300
312OFN	3/1/2001 14:38	5000	230
312OFC	3/1/2001 14:45	5000	2
312OFL	3/1/2001 15:10	5000	20
312ORC	4/6/2001 13:00	13000	200
312SMI	4/17/2001 8:30	13000	500
312ALA	4/17/2001 11:00	800	80
312SMA	4/24/2001 9:00	2400	790
312SMA	5/29/2001 9:00	35000	2400
312SMA	6/26/2001 9:00	24000	24000
312SMA	7/26/2001 9:20	18800	3500
312SMA	8/27/2001 9:25	7900	790
312SMA	9/19/2001 8:50	35000	490
312SMA	10/22/2001 9:19	11000	3300
312SMA	11/19/2001 9:01	5400	230
312SMA	12/13/2001 9:26	24000	490
312SMA	1/15/2002 8:56	4000	40
312SMA	2/19/2002 8:27	2400	2400
312SMA	3/12/2002 9:32	17000	500
312SMA	4/9/2002 9:21	24000	1600
312SMA	5/7/2002 8:49	3000	2400
312SMA	6/6/2002 9:14	30000	900
312SMA	6/26/2002 9:19	90000	7000
312SMA	7/29/2002 8:51	17000	300
312SMA	8/28/2002 8:51	160000	3000
312SMA	9/25/2002 9:05	22000	1400
312SMA	10/23/2002 8:38	30000	500
312SMA	11/21/2002 9:22	2400	1400
312SMA	12/19/2002 8:57	30000	230
312SMA	2/19/2003 8:48	17000	300
312SMA	3/19/2003 8:48	30000	300
312SMA	3/3/2004 9:50	22000	140
312SMA	4/1/2004 12:56	160000	2400
312SMA	5/20/2004 10:39	30000	1700
312SMA	6/24/2004 11:47	30000	5000
312SMA	8/2/2004 11:17	90000	8000
312SMA	8/2/2004 11:17	90000	8000
312SMA	8/30/2004 9:18	28000	300
312SMA	1/4/2007 9:57	90000	300
312ALA	1/29/2007 12:26	500	230
312BCU	1/30/2007 12:13	28000	1700
312BCD	1/30/2007 13:07	1700	230
312MSD	1/30/2007 13:20	90000	3000
312NIP	1/30/2007 14:13	2400	500
312NIT	1/30/2007 14:45	500	50
312NIT	1/30/2007 14:55	300	40
312OFL	1/31/2007 9:13	900	80
312SMA	1/31/2007 10:43	8000	800

312ORC	1/31/2007 11:12	8000	80
312ORI	1/31/2007 11:45	5000	170
312GVS	1/31/2007 12:16	3500	130
312GVT	1/31/2007 12:40	9000	30
312ORB	1/31/2007 13:06	1300	800
312ORB	1/31/2007 13:16	1700	700
312ALA	2/26/2007 12:36	900	30
312NIP	2/26/2007 13:05	8000	5000
312NIT	2/26/2007 14:25	1300	300
312NIT	2/26/2007 14:35	1600	140
312BCU	2/27/2007 12:53	160000	3000
312BCD	2/27/2007 13:32	50000	800
312MSS	2/27/2007 14:14	160000	2400
312MSD	2/27/2007 14:26	90000	5000
312OFL	2/28/2007 10:06	1700	270
312SMA	2/28/2007 10:56	160001	900
312ORC	2/28/2007 11:35	160000	500
312ORI	2/28/2007 12:04	160001	240
312GVS	2/28/2007 12:28	160000	500
312GVT	2/28/2007 12:52	160001	300
312ORB	2/28/2007 13:18	17000	2200
312ORB	2/28/2007 13:28	50000	3000
312ALA	3/27/2007 12:33	5000	800
312BCU	3/28/2007 11:41	7000	300
312BCD	3/28/2007 12:37	5000	50
312MSS	3/28/2007 13:18	2200	50
312MSD	3/28/2007 13:33	160000	1600
312NIP	3/28/2007 14:10	8000	3000
312NIT	3/28/2007 14:37	2400	170
312NIT	3/28/2007 14:51	1600	240
312OFL	3/29/2007 9:44	800	300
312SMI	3/29/2007 10:19	5000	300
312SMA	3/29/2007 11:21	22000	300
312ORC	3/29/2007 12:07	22000	70
312ORI	3/29/2007 12:45	160000	2400
312GVS	3/29/2007 13:39	22000	170
312GVT	3/29/2007 13:57	11000	50
312ORB	3/29/2007 14:24	5000	1300
312ORB	3/29/2007 14:34	9000	2400
312ALA	4/24/2007 13:12	1300	400
312BCU	4/25/2007 11:40	24000	3000
312MSS	4/25/2007 12:09	1400	300
312MSD	4/25/2007 12:21	160000	2400
312BCD	4/25/2007 12:40	50	23
312NIP	4/25/2007 13:16	2400	800
312NIT	4/25/2007 13:42	3000	230
312NIT	4/25/2007 13:52	1700	240
312OFL	4/26/2007 10:14	1100	110
312SMA	4/26/2007 11:09	17000	3000

312ORC	4/26/2007 11:46	90000	2400
312ORI	4/26/2007 12:03	50000	240
312GVS	4/26/2007 12:36	30000	300
312GVT	4/26/2007 12:47	13000	230
312ORB	4/26/2007 13:16	90000	2400
312ORB	4/26/2007 13:26	160001	5000
312ALA	5/29/2007 10:26	1100	300
312BCU	5/30/2007 11:51	5000	300
312BCD	5/30/2007 12:19	50000	3000
312MSS	5/30/2007 12:42	2400	240
312MSD	5/30/2007 12:50	160001	3000
312NIP	5/30/2007 13:21	7000	300
312OFL	5/31/2007 9:40	2400	80
312OFC	5/31/2007 10:16	30000	2400
312OFN	5/31/2007 10:43	5000	230
312BSR	5/31/2007 11:05	17000	2400
312SMA	5/31/2007 12:03	28000	2400
312ORC	5/31/2007 12:22	90000	3000
312ORI	5/31/2007 12:41	2200	300
312GVS	5/31/2007 13:19	2400	240
312GVT	5/31/2007 13:36	160000	3000
312ORB	5/31/2007 14:01	9000	1300
312ORB	5/31/2007 14:11	5000	1700
312ALA	6/25/2007 11:50	800	300
312BCU	6/26/2007 11:48	3000	240
312BCD	6/26/2007 12:01	160001	2400
312MSS	6/26/2007 12:28	13000	2300
312MSD	6/26/2007 12:50	35000	900
312OFL	6/27/2007 9:11	3000	800
312OFC	6/27/2007 9:40	11000	500
312OFN	6/27/2007 9:58	3000	300
312BSR	6/27/2007 10:24	160001	300
312SMA	6/27/2007 11:15	160001	5000
312ORI	6/27/2007 13:13	30000	80
312GVS	6/27/2007 13:40	9000	300
312GVT	6/27/2007 14:00	50000	800
312ORB	6/27/2007 14:33	5000	1300
312ORB	6/27/2007 14:43	8000	5000
312MSS	7/16/2007 14:16	24000	1300
312MSD	7/16/2007 14:26	160000	2400
312BCU	7/16/2007 15:02	17000	240
312ALA	7/17/2007 12:32	2200	300
312OFL	7/18/2007 9:04	1700	800
312OFC	7/18/2007 9:36	30000	500
312OFN	7/18/2007 10:03	16000	80
312BSR	7/18/2007 10:25	50000	700
312SMA	7/18/2007 11:18	160000	1600
312ORC	7/18/2007 11:41	50000	700
312ORI	7/18/2007 12:46	160001	30000

312GVS	7/18/2007 13:15	5000	500
312GVT	7/18/2007 13:37	160001	24000
312ORB	7/18/2007 14:00	3000	1300
312ORB	7/18/2007 14:10	5000	1300
312MSS	8/28/2007 14:13	90000	5000
312MSD	8/28/2007 14:21	160000	24000
312BCD	8/28/2007 14:45	30000	3000
312BCU	8/28/2007 15:22	1700	110
312ALA	8/29/2007 12:12	1700	500
312BCF	8/29/2007 13:31	160000	5000
312OFL	8/30/2007 9:44	5000	500
312OFC	8/30/2007 10:05	160000	2400
312OFN	8/30/2007 10:22	11000	800
312BSR	8/30/2007 10:42	17000	2400
312SMA	8/30/2007 11:28	11000	500
312ORC	8/30/2007 11:52	30000	1300
312ORI	8/30/2007 12:09	160001	5000
312GVS	8/30/2007 12:31	24000	300
312GVT	8/30/2007 12:50	160001	2400
312ORB	8/30/2007 13:18	13000	2300
312ORB	8/30/2007 13:28	13000	300
312ALA	9/25/2007 12:13	300	80
312MSS	9/25/2007 13:18	160000	2400
312MSD	9/25/2007 13:28	50000	3000
312BCD	9/25/2007 13:49	17000	800
312BCU	9/25/2007 14:21	24000	240
312OFL	9/26/2007 9:13	1700	500
312OFC	9/26/2007 9:43	13000	3000
312OFN	9/26/2007 9:59	8000	30
312ORC	9/26/2007 10:54	17000	5000
312SMA	9/26/2007 11:00	22000	2200
312ORI	9/26/2007 11:54	160001	240
312GVS	9/26/2007 12:15	1400	30
312ORB	9/26/2007 12:56	5000	300
312GVT	9/26/2007 13:06	8000	300
312ORB	9/26/2007 13:33	2400	500
312ALA	10/31/2007 12:01	350	80